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JAN 19 1931

ELECTRICAL WORLD

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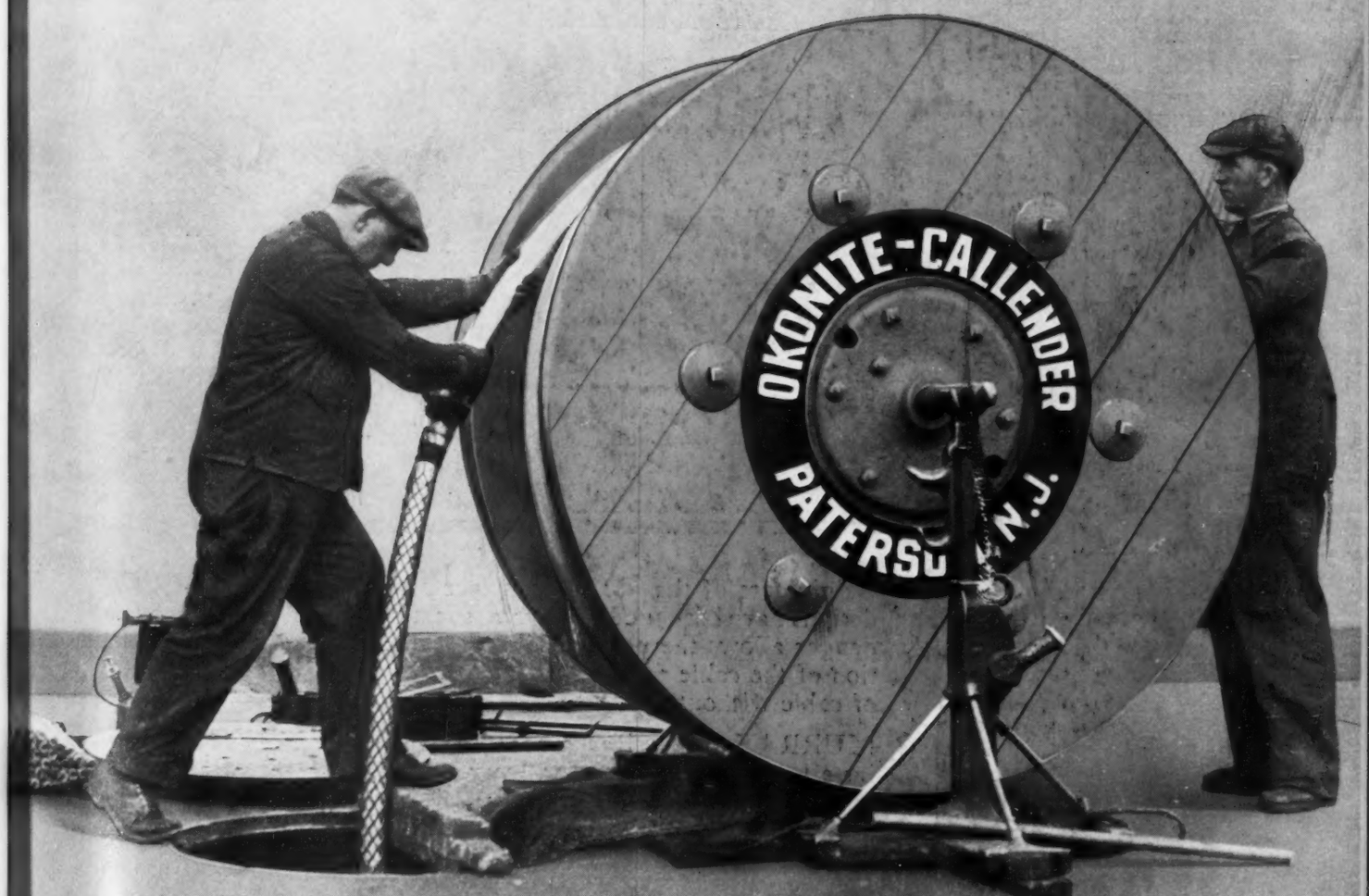

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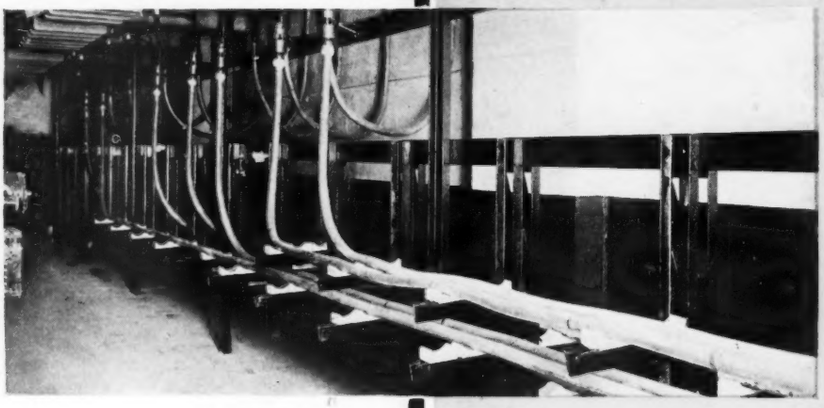

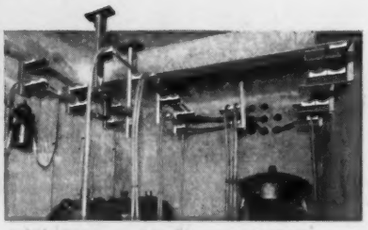

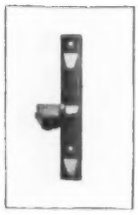

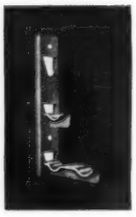

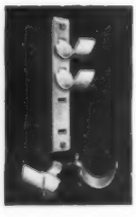

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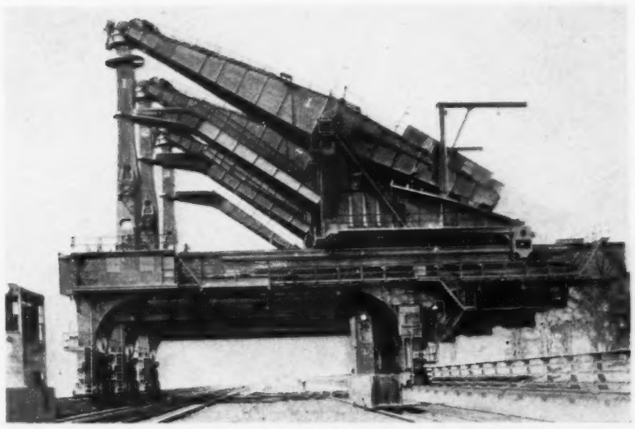

Ore ship unloaders Toledo, Ohio

JANUARY 17, 1931

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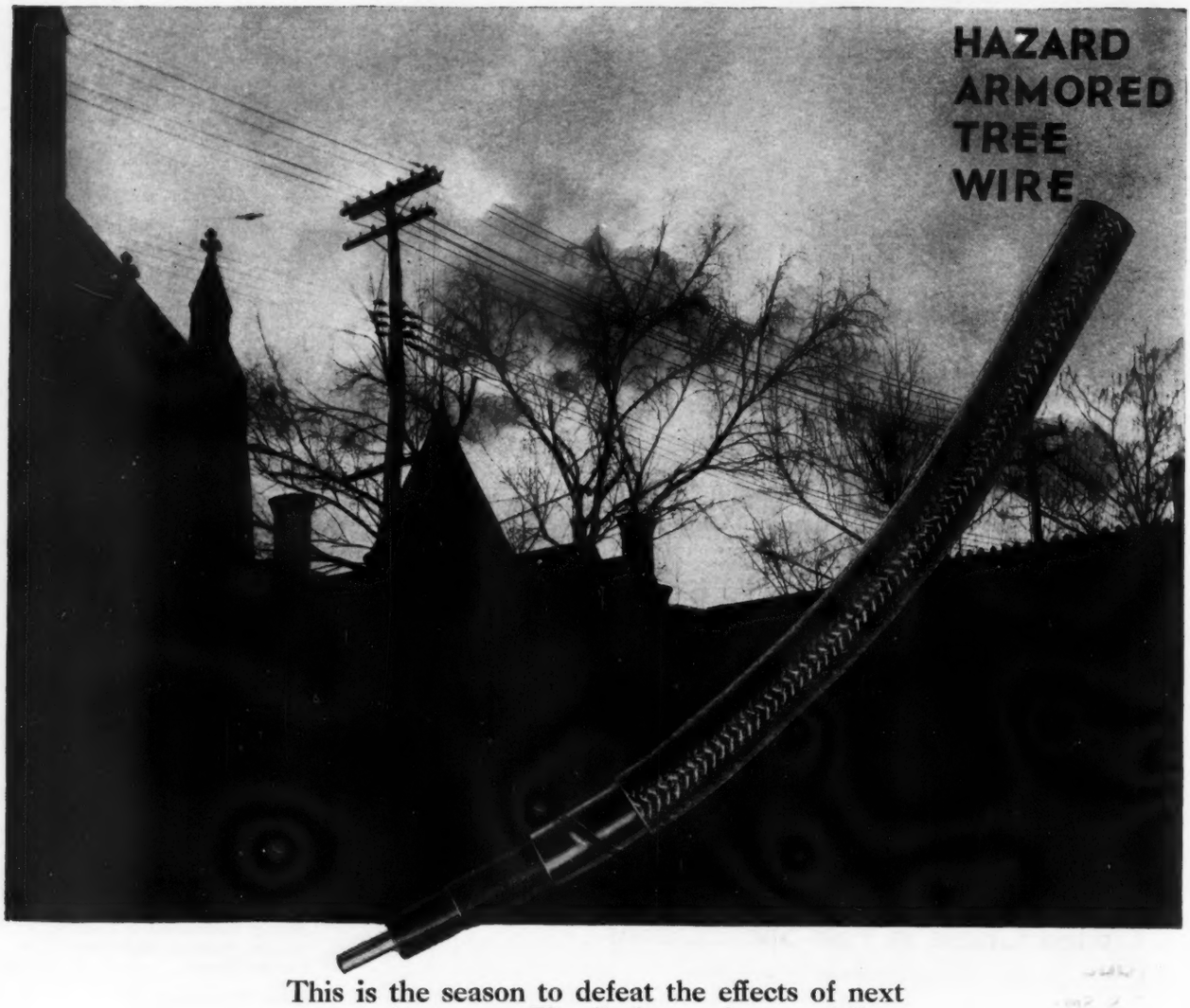
SPLICE IN TREE WIRE WHEN THE LIMBS ARE BARE OF LEAVES



This is the season to defeat the effects of next summer's storms. The limbs are bare and linemen can see what to do.

Insure continuity of service with Hazard Armored Tree Wire, which is so resistant to abrasion that even if the outer braid of hard laid seine twine be rubbed through, the helically wrapped non-metallic armor tape will continue to protect the insulation from wear.

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ELECTRICAL WORLD

for the Week Ending

January 17, 1931

N. Y. board favors utility disposal of St. Lawrence power

Senate would recall new commissioners, is rebuked by Hoover

IS HE JUSTIFIED?

Underwood & Underwood

We can, of course, have no objection to a reasonable return for the real investor in stocks of utility companies; indeed, we should actually do everything possible to safeguard such reasonable return for him. The difficulty is rather with those who seek unreasonably to inflate profits and promote speculative trading by so pyramiding capital structures in holding companies and otherwise that profits are made on stock which is not always represented by actual investment.

FRANKLIN D. ROOSEVELT,
Governor New York State

—**Peak capacity for $24 per kw.** is promise on basis of tests conducted in three modern stations. By shutting off bleeder heaters and using hot-water storage in accumulators for feedwater the job is done—*p. 136.*

—**Senate regrets approving vote** and asks that new power commissioners be let out for discharging employees. Whereupon the President storms defiance with the rage of innocence—*p. 129.*

—**Sell river power to utilities** is recommendation of St. Lawrence board, which also urges local industrial developments near plant. This way the utilities get the power and the Governor the glory—*p. 126.*

—**Investment yardsticks defined** from insurance company viewpoint. As loaners of 11 per cent of industry's borrowed funds their demands are important—*p. 149.*

—**Trade Board hits its stride** as announced schedule of investigations touches two organizations in as many weeks. Washington Water Power next; then Alabama Power—*p. 131.*

—**Railroad electrification sped** on economy basis is contention of engineer who backs opinion with facts. Return on capital investment of one group over eight-year period, 19 to 32 per cent.—*p. 153.*

—**Large mercury-vapor turbine** now planned for Schenectady as General Electric decides to lease power station to utility, obtaining electricity and steam for its own use as needed—*p. 129.*

St. Lawrence Board Wants Existing Lines Used Under Contract with Utilities

IMMEDIATE creation of a "public power authority" to undertake development of the international section of the St. Lawrence River for production of electric power, and immediate appointment of the trustees, is recommended to Governor Franklin D. Roosevelt and the New York Legislature in the report of the St. Lawrence Power Development Commission, made public on Thursday of this week. Its publication had been preceded by statements giving the findings of the commission's engineering board (ELECTRICAL WORLD, January 10, page 82) and of its marketing and legal experts, as summarized in following columns.

The commission finds that it is entirely practicable to construct the necessary project and to market New York's share of the power which would be developed in such a way as to serve the best interests of the state and protect the people in their ownership of the great water-power resource. Utilization of existing transmission and distribution systems is recommended under a contract with the operating companies which would assure to the consumers the advantages incident to development of this low-cost power by a public power authority.

"Representatives of utility companies," the commission reports, "have expressed a willingness to make such a contract as will achieve, in effect, a wide distribution of the power and insure to consumers the full development of the power, with only such compensation for the use of the facilities of the companies as will be fair and reasonable. The terms of such a contract can probably be worked out upon the basis of definite cost figures for generating, transmitting and distributing the power."

The commission recommends that all such contracts shall require the approval of the Governor and be consummated only after their proposed terms have been published and public hearings held to give opportunity for thorough consideration. "The anticipated reduction in rates to domestic consumers," the commission finds, "will stimulate extension of service to rural consumers not now served, and still further extensions would be made possible if the state should see fit to adopt some method of subventions to the localities."

Alternative disposition of power

In the event of the inability of the trustees successfully to make such a contract with private companies, the commission proposes that they shall have such powers as are necessary to make other disposition of the power. All these provisions are embodied in eleven formal recommendations.

The commission expresses the opinion that it is practicable to encourage certain types of industry to locate at or near the site of the power house, and that within a reasonable time, if the power authority be created and authorized to solicit and make contracts, a demand from such industries can be assured sufficiently substantial to finance the project. If not supplemented by other means of marketing, this would contribute to the state's welfare through the industrial development that would be promoted. The commission believes, however, that distribution of the power or its equivalent directly to the homes of the state would serve better the economic goal of giving the benefits to the consuming public in the most direct manner possible.

"It is not economically wise," the commission reports, however, "to parallel existing transmission or distributing systems except as a possible solution in the event of failure of private utility companies to enter into a contract with the public power authority on a fair and reasonable basis."

"The marketing problem for St. Lawrence power is complicated in this respect," the report says: "that the most available customers for this power are those who can use constant power, whereas the domestic consumers of power, to whom the maximum benefits of this project should go, use the current on the average only a few hours a day. If any substantial part of the actual power generated on the St. Lawrence is to be delivered to domestic consumers, great waste would be involved unless provision were made to supplement it with power from other sources (from steam or from impounded water) to meet the peak of the demand, using St. Lawrence power to care for the

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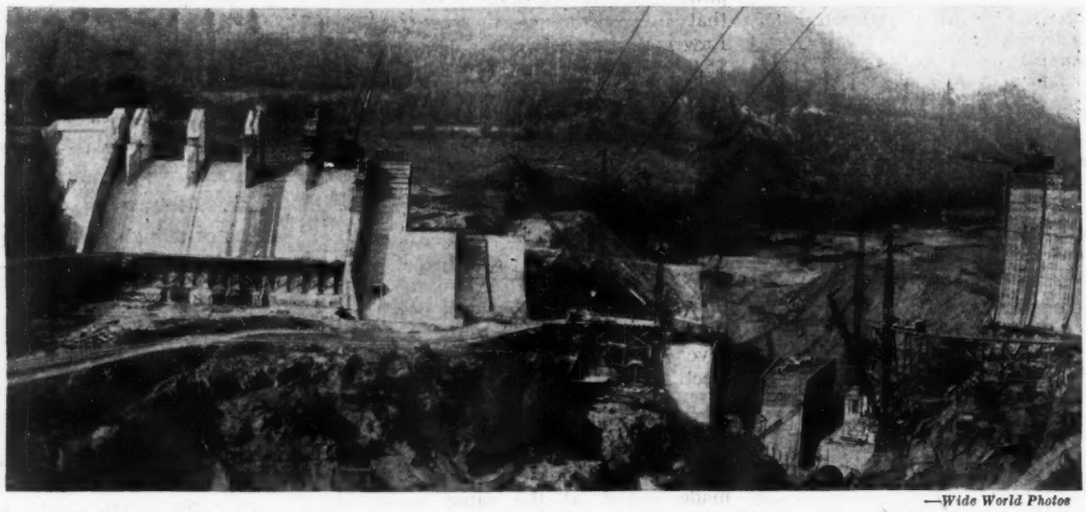
ARIEL HYDRO PLANT WILL BE OPERATING NEXT YEAR



—Wide World Photos

Scheduled for completion next summer, work is being pushed on the Northwestern Electric Company's 60,000-hp. hydro project on the Lewis River in southwestern Washington. The dam, 313 ft. high, will be equipped with a large fish ladder. Power will be delivered at Portland, Ore., and Vancouver, Wash.

portion of the demand which is steady."

A discussion of the general principles that should govern the contract and of the benefits and limitations of the form of public financing proposed follows. The commission also expresses the belief that it has already laid "the foundation for most friendly and constructive co-operation" with the Province of Ontario.

The report was signed by Chairman Robert M. Haig, Julius H. Cohen, Frederick M. Davenport and Samuel L. Fuller. Former Lieutenant-Governor Thomas H. Conway, the remaining member of the commission, refused to sign. It is possible that he may issue a report of his own, dealing particularly with distribution of the energy, this being the point on which he dissents from the majority.

The Legislature has extended the commission's term of service until the Legislature shall adjourn unless otherwise decided later.

▼

"NO LIGHT, BUT RATHER DARKNESS VISIBLE"

—Internat. News Reel Photo.

This photograph was taken recently in London at 2 p.m. What must London fogs have meant before electricity gave the Miltonic adjective a peculiar aptness!

▽ ▼ ▼

St. Lawrence Commission Marketing Board Reports

THAT "THE BEST WAY to utilize the St. Lawrence power, in order to preserve its direct and indirect economic advantages, would be to use a certain portion of it at the site in continuous industries and distribute the balance in existing markets where it could be mingled with power from other sources, such as steam-generated electricity and power from inland streams controlled by storage," is the outstanding recommendation make by the marketing board of the St. Lawrence Power Development Commission as the result of long and painstaking research. This board consists of Colonel John P. Hogan, consulting engineer, and Dr. John Bauer, utility expert. The board expresses the belief that by 1937, the earliest year in which power could be produced on the St. Lawrence, the market for energy in New York State can absorb beneficially the output of the river.

"The best way in which the appropriate utility market could be obtained for the ultimate development of St. Lawrence power in order to realize full economic benefits would be by contract, on fair and reasonable terms, with the existing electric utilities," the report continues. "It is our opinion that a contract with the utilities could be made which would permit the immediate realization of all the direct benefits and the subsequent transfer of indirect benefits to users. If no satisfactory contract can be made with existing utilities, it is our opinion that a profitable initial development can be made immediately for industries at the site and for distribution in the immediate vicinity.

"Assuming that the power were distributed to industries at the site and the existing utilities, it is our opinion that the entire output could be absorbed in these markets within a reasonable time after the project was completed.

"The direct benefit due to the development of St. Lawrence power by a public agency would be the difference between the cost of such power delivered at the load centers and the cost of producing the same quantity of power by existing steam or other power," the board says. "We estimate that this difference in favor of St. Lawrence power would be between $5,000,000 and $12,000,000 per year. The uncertain factors in this are the probable costs of generating electricity at the load centers by steam or from interior water power in and after 1937 and the relative amount of power which can be absorbed by industries and utilities at that time."

Throughout the report there runs a note of warning as to two dangers—that of considering the cost of generation without bearing in mind that it is a very small part of the cost of getting electricity to the actual user, and that of forgetting, in computing the generation costs, the vital importance of load factor.

A second report on marketing was made public at the same time, this report being from the commission's engineering board and supplemental to the report by it abstracted last week concerning the selection of a site. The engineering board came to much the same conclusion as the marketing board. It says that "in the ordinary systematic development of this project we may expect that industries of various sorts will migrate to the area near the source of power" and points to the danger in overdoing long-distance transmission. On the latter point the engineering board says:

Transmission to metropolis

"It is physically possible to transmit this power directly to the New York City area, but to transmit 1,000,000 hp. such a distance would require an expenditure of approximately $75,000,000. . . . Economic requirements would demand higher transmission voltage than has been attempted outside the electrical laboratories. There is no known practical way so to design and build these lines that they will be free from interruptions. It is doubtful whether there is a market for such a large block of power at high load factor in New York City which would submit to such interruptions."

Another finding of the engineering board is:

"To obtain conservation it will be necessary that this project be interconnected with other transmission systems. If this be done, the base load of the interconnected system can be carried by the Massena Point plant, which will permit the greater use of existing and projected hydro-electric projects and steam-power plants on peak loads."

ARC-WELDED WATER PIPE REPLACES WOOD

—Courtesy Lincoln Electric Company

Nineteen miles of arc-welded steel pipe, replacing a wooden-stave line and with ultimately two and one-half times its capacity, will carry water from the Otay Reservoir to San Diego, Calif. The 30-ft. sections were arc-welded in the field. The line is carried in tunnels through four large hills, tunnel lengths being welded outside and then rolled in.

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State's Legal Rights on St. Lawrence Upheld

ANOTHER ST. LAWRENCE report just made public by the state power development commission is that of the commission's counsel and law staff, headed by Julius Henry Cohen. This body investigated the state's power to proceed with the development as affected by (1) its own constitutional provisions, (2) the rights of riparian owners, (3) the rights of the United States and the bearing of the federal water-power law, and (4) the international character of the stream.

Briefly paraphrased, its findings are: (1) that the state has authority to develop water power through a public agency, which may be of an international nature; (2) that riparian rights are subject to the paramount right of the state and of the United States, the state, in its proprietary capacity, being the absolute owner of the southerly half of the bed of the river and of the water power inherent in the flow over this part of the bed; (3) that it is practicable to apply for a license under the federal water-power act without the waiver of substantial rights, contention over the constitutionality of that act, which the report disputes (particularly as to the recapture provisions), being waived to avoid the inevitable delay that such a contest would cause and because of the remoteness of likelihood that the United States would assert the right of recapture at the end of the license period and be upheld in such assertion; (4) that, on the acquirement of a federal license, application for approval of the plan be made to the International Joint Commission under the treaty between the United States and Canada.

A possible alternative course of action is suggested in the matter of obtaining federal approval. This is to seek a special act of Congress exempting the project entirely from the operation of the federal water-power act or from certain of its specific provisions such as the right of recapture.

▼

Government Wants Alabama Tax Claim Dismissed

THE GOVERNMENT'S ANSWER to Alabama's suit to collect taxes from the United States on the ground that it is in the business of manufacturing and selling hydro-electric power in that state is that the suit should be dismissed, the Department of Justice announces in a brief just filed with the Supreme Court. "The United States has not consented to be sued upon any ground alleged in the petition," says the brief. "Without such consent the Court of Claims has no jurisdiction." The department reviews the case briefly as basis for its recommendation.

Muscle Shoals Glides from Deadlock to Deadlock

CONFEREES ON MUSCLE SHOALS went into another deadlock this week—this time, it is reported, on the question whether, as the Senators believe, the nitrate plant should be used for making fertilizers or whether, as the House members think, it should be used for making fertilizer to a certain point, and then to make chemicals. Representative Reece and Senator McNary, prominent conferees, were represented as despairing of any agreement, and Senator Norris walked out of the conference.

▼

Magrath Summarizes Hydro Progress in 1930

VERY SUBSTANTIAL GROWTH is indicated in the operations of the Ontario Hydro-Electric Power Commission, according to a review of 1930 by the retiring chairman, Charles A. Magrath. Capital investment now stands at $358,000,000 and the people of 668 municipalities are served with light and power.

In October, 1930, the power supplied by the commission aggregated 1,260,000 hp., and, notwithstanding the industrial depression, the loads supplied by the commission to municipalities increased in the past year. The commission, broadly speaking, has provided 800,000 hp. to meet the needs of the future, which will bring the total in use in the next few years to about 2,000,000 hp.

▼

Ontario Municipal Hydro Bodies Meet Jointly

A JOINT CONVENTION of the Ontario Municipal Electrical Association, representing the municipalities taking power from the Ontario Hydro-Electric Power Commission, and the Associated Municipal Electrical Utilities was held in Toronto on January 8-9, with an attendance of about 2,000. The feature of outstanding interest was the announcement by Charles A. Magrath that he had tendered his resignation as chairman of the commission. He defended the action of that body in obtaining power from Quebec Province.

The committee on merchandising of the Associated Municipal Electrical Utilities recommended that the Hydro-Electric Commission, should increase its activities in the sale of electrical appliances, confining the business to goods made in Canada. J. W. Peart of St. Thomas was elected president of this body, and Alfred C. Maguire was re-elected president of the Ontario Municipal Electrical Association.

Hoover Refuses to Send Power Men's Names Back

A VOTE WAS TAKEN in the United States Senate on Saturday last upon the motion of Senator Walsh of Montana asking the President to return the Senate's communication approving the appointment of George Otis Smith, Marcel Garsaud and Claude L. Draper to the Federal Power Commission. The motion was carried by 36 to 23, the majority being made up of Democrats and insurgent Republicans. Mr. Hoover lost no time in notifying the Senate that he would not accede to its request, saying:

I am advised that these appointments were constitutionally made, with the consent of the Senate formally communicated to me, and that the return of the documents by me and reconsideration by the Senate would be ineffective to disturb the appointees in their offices. I cannot admit the power in the Senate to encroach upon the executive functions by removal of a duly appointed executive officer under the guise of reconsideration of his nomination.

The President also made public an explanatory statement of considerable length. In this he said among other things:

I cannot allow a false issue to be placed before the country. There is no issue for or against power companies. . . . The resolution of the Senate may have the attractive political merit of giving rise to a legend that those who voted for it are "enemies of the power interests" and, inferentially, those who voted against it are "friends of the power interests," and it may contain a hope of symbolizing me as the defender of power interests if I refuse to sacrifice three outstanding public servants or to allow the Senate to dictate to an administrative board the appointment of its subordinates, and if I refuse to allow fundamental encroachment by the Senate upon the constitutional independence of the Executive. Upon these things the people will pass unerring judgment.

Much of the debate indicates plainly that those who favored this resolution are intent upon removing Messrs. Smith, Draper and Garsaud, not because they are unqualified, but to insist upon the Senate's own selection of certain subordinates. Irrespective of the unique fitness of these commissioners for their positions and before they have given a single decision in respect to any power company, they are to be removed unless they are willing to accept employees not of their choosing. . . . If the appointments of these commissioners are withdrawn, it is obvious that their successors must accept the Senate's views of these subordinates. . . .

I regret that the government should be absorbed upon such questions as the action of the Power Commission in employment or non-employment of two subordinate officials at a time when the condition of the country requires every constructive energy.

What the nature of the Senate's next move will be is uncertain. The names of the three commissioners concerned have been restored to the calendar as if unconfirmed, though the futility of this procedure appeared to be apparent to Senator Walsh and others opposing the commissioners. Senator Wheeler gave notice that he would oppose an appropriation for their salaries when the bill containing it is brought in.

▼

Electric Control Brings Two-Car Elevator Shaft

WESTINGHOUSE ENGINEERS have, according to a statement by H. D. James, consulting engineer for the Westinghouse Electric Elevator Company, solved a problem that has long puzzled designers of high office buildings—that is, how to provide the fast and frequent elevator service that is essential without encroaching unduly on the building area and thus reducing revenue from rents. By new combinations of electrical control applied to the motors driving the elevator cars the Westinghouse men have succeeded in operating two cars—one express and one local—in the same shaft.

In the case of a twenty-story building the upper car, the express, will, according to this plan, start from the street level and run without stop to floor eleven, serving all the floors from there up, while the lower car will start from the basement and serve the lower ten floors. Ample provision for safety is made by three systems—one electrical and two mechanical—it being impossible for the lower car to bump the upper one or for the upper car to descend while the lower one is ascending or to overtake the lower car on the descent.

An elevator installation of this type has been placed in service in the main office building of the Westinghouse Electric & Manufacturing Company in East Pittsbugh, Pa., and serves eleven stories. The cars operate at 600 ft. per minute and each can carry 3,000 lb.

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Large Mercury-Vapor Turbine for Schenectady

WORK WILL SOON be started on a 20,000-kw. mercury-vapor turbo-generator, to be installed in Schenectady, N. Y., and cost $4,000,000, according to an announcement made by Burton L. Delack, manager of the General Electric Company's works in that city. This, the company says, will be the first outdoor steam plant and the first power plant to co-ordinate industrial requirements with utility sources of power. The turbine will be twice as large as the Schenectady-built mercury-vapor unit in service at the South Meadow station of the Hartford Electric Light Company, and, because of increased pressure and temperature, it will be even more efficient than the Hartford installation.

The new generating station, which will be built on General Electric property between the old and new river roads,

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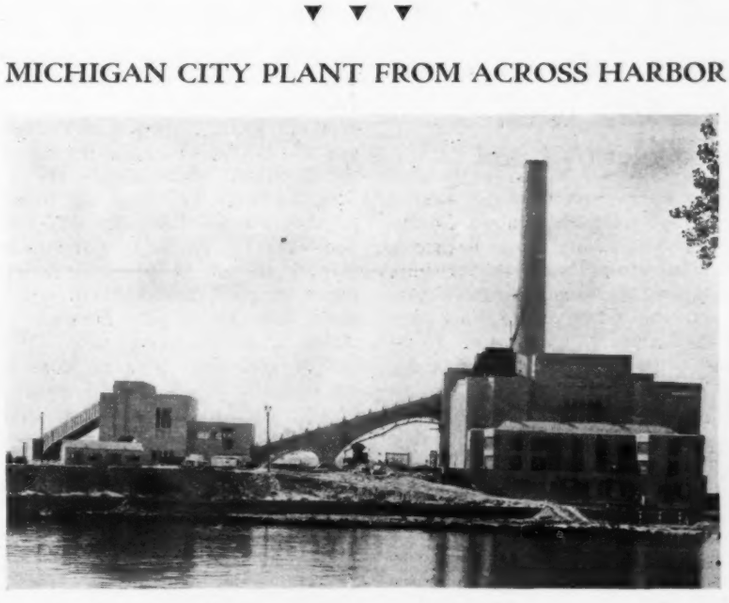
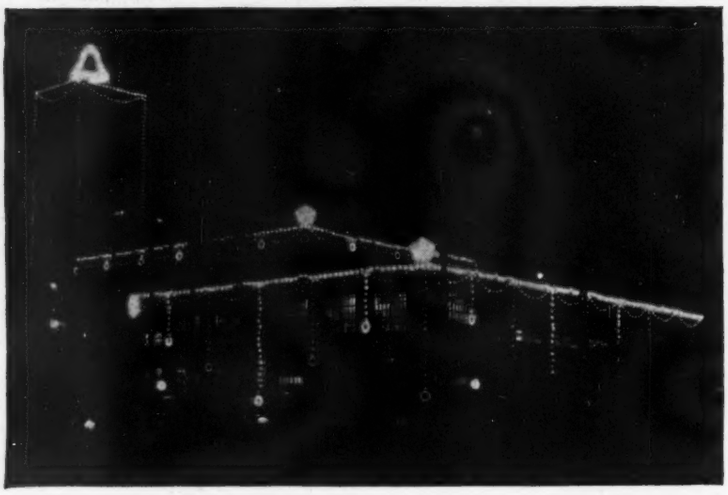
MICHIGAN CITY PLANT FROM ACROSS HARBOR



The Northern Indiana Public Service Company's new 68,000-kw. single-unit (Westinghouse) generating station went into service on January 9. It will be the key station of the company named and an important unit in the great Chicago power pool. It covers 5,200 ft. of shore line on Lake Michigan.

BIG SIOUX STATION CELEBRATES HOLIDAYS



By means of 2,000 red, green, amber and white lamps, the Sioux City Gas & Electric Company beautified its largest plant and stimulated Christmas home lighting. The bell on the tower is 13 ft. x 10 ft. and contains 200 lamps.

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will be leased to and operated by the New York Power & Light Corporation and will supply electricity for the power company and steam for use by the General Electric Company. A reinforced-concrete tunnel three-fifths of a mile long will be built from the generating station to the front end of the General Electric works for the supply of steam to a non-condensing steam turbine, twenty old boilers in the building containing this turbine being dismantled.

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Cheat River License Ruled Out by Court

A FORMAL ORDER reversing the decision of the West Virginia Public Service Commission in awarding a license to the West Virginia Power & Transmission Company to develop hydro-electric power on the Cheat and Blackwater Rivers, and remanding the case to the commission for further proceedings, was entered at Charleston, W. Va., on January 10 by the Kanawha County Circuit Court. The company is allowed 60 days under the law to take an appeal to the State Supreme Court.

The opinion upheld the constitutionality of the 1929 water-power act, but asserted that the Public Service Commission had misconstrued its purposes. The court said that the license authorized by the commission was "sadly lacking" in economic advantages to the state, and, strictly construed, the purpose of the water-power act was to insure such advantages. It was not a revenue measure. The court further held that the commission had failed to make a thorough investigation of the economic benefits that might accrue to the state, as contemplated by the act. (ELECTRICAL WORLD, July 12, 1930, page 56, and September 20, page 511.)

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Six States Oppose Suit of Arizona Against Dam

IN BRIEFS FILED with the United States Supreme Court on January 12 the States of California, Nevada, Utah, New Mexico, Colorado and Wyoming and the Secretary of the Interior urged the dismissal of Arizona's suit to enjoin the carrying out of the provisions of the Boulder Dam act. The bill of complaint by means of which Arizona started the suit mentions as defendants the other six Colorado Basin states and the Secretary of the Interior. It is stated in the answering briefs that the bill of complaint fails to state a case for equitable relief since the prosecution of the work under the act involves no actual or threatened interference with any existing right of Arizona.

Another point made in the answering briefs is that the bill of complaint does not join the United States. It is argued that an action to restrain the Secretary of the Interior from constructing works authorized by Congress is in substance an action against the United States and one which may not be maintained without the consent of Congress. The contention by Arizona that the Boulder Dam act is unconstitutional is disputed by the defendant states, which maintain in their briefs that Congress has sufficient power under the commerce clause to order the construction of the project.

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Power and Regulation in State Legislatures

ARIZONA.—George W. P. Hunt, seven-term Governor, declaring that "Arizona can expect neither justice nor consideration from the executive departments of our national government," again denounced the whole Hoover Dam set-up in his inaugural address and appealed to the Legislature for an appropriation to continue the fight.

MASSACHUSETTS. — Governor Joseph B. Ely in his message to the Legislature submitted for consideration "the proper regulation of holding companies which are now the means of circumventing the present laws of the commonwealth in reference to the regulation and ownership of utilities."

MISSOURI. — "Reasonable development of water-power resources may be expected to exert a wholesome influence on the economic advancement of the state in future years," said Governor H. S. Caulfield in his annual message, referring to the absence of any Missouri law to control such development. "Such development should be encouraged, but it should be accompanied by proper safeguards and restrictions to protect the public interest. The state should not be left helpless while its natural resources, the heritage of its citizens, pass into private hands. The enjoyment of the great natural scenic beauty of our state is a public right. The great springs and streams of the Missouri Ozarks must be protected against unnecessary or unwarranted exploitation. Power should be vested in a state agency to determine whether a proposed water-power project is in accord with the public interest and to regulate the construction, operation and maintenance of all dams and water powers."

NEBRASKA. — Governor C. W. Bryan recommended in his inaugural message laws to permit the development and ownership of the water powers of the state by government units in districts of suitable size and character, predicting that by this means great sums would be saved to users of electrical energy, making possible the lighting and heating of every home in the state and the operation of farmers' and home owners' machinery at a nominal cost compared to what is now being paid. The Governor said that such a policy, with the new law permitting municipal plants to make extensions where they will, would open an era that "has long

been denied the people through the political influence of privately owned plants." He also recommended legislation permitting the formation of combined irrigation and power districts and extending to existing irrigation districts the right to generate and sell light and power.

NEW HAMPSHIRE. — Retiring Governor Charles W. Tobey told the General Court that the Public Service Commission was "one of the most important departments of our state government." Touching on the commission's investigation into the Associated Gas & Electric Company System, he observed: "This investigation has been thoroughly justified and should be carried on to completion. What our Public Service Commission is interested in is whether the consumers of our state who patronize these utilities are receiving the rate advantages to which they are entitled, or whether or not the methods employed and the entire relation of the operating company with the holding company constitute proper management and operation from the standpoint of the consumers' welfare."

NEW YORK.—The New York State Conference of Mayors recommends to the Legislature amendments to the public service law providing that the commission shall increase rates of public utilities only after a hearing on notice to the municipalities affected, that the commission shall have power to impose conditions in permitting abandonment of a franchise, that reports by public utilities to the commission show separately receipts of the utility in each municipality, that property values reported by public utilities for tax purposes be presumptive evidence of the value of same property for rate-making purposes (this recommendation is a radically new departure), and that cities and villages shall have notice of and right to become parties to all proceedings by the commission affecting rates within the municipality.

OHIO.—The appointment of John W. Bricker, Columbus, as a member of the Ohio State Public Utilities Commission, over whose membership there has been much political contention, has been confirmed by the Ohio Senate by a strictly party vote, with a majority of only one. This means that the two Republican appointees of Governor Myers Y. Cooper, Mr. Bricker and former Judge Frank W. Geiger, Springfield, will control the commission throughout the entire administration of Governor George White. Mr. Bricker fills an unexpired term and will serve until February, 1933.

TEXAS.—State regulation of public utilities is provided in a bill to create a Public Utilities Commission of three members, each to receive $10,000 a year. Power to fix utility rates is left to the cities and towns and to county commissioners' courts, but appeal to the commission is provided and from the commission up to the Supreme Court. Utilities must follow the commission's forms of accounting and must submit statements of investments in Texas, showing the value of physical properties, operating cost and separate cost for each unit or plant. The commission is empowered to call for additional data, hold hearings and determine valuations for rate making. Utilities are to be taxed one-fourth of 1 per cent of each year's gross receipts for the support of the commission.

VERMONT.—"The present basis of taxation of public utility companies, and especially hydro-electric companies, is unsatisfactory," said Governor Stanley C. Wilson in his inaugural message to the General Assembly. He submitted for consideration the report of a special tax commission recommending that study be given the subject either by a legislative committee or by an interim commission. "Storage reservoirs and power developments are not things of beauty," the Governor remarked, "and themselves uncontrolled may have as devastating effect on a valley as an occasional flood. The State of Vermont should have first claim on the electrical energy developed in the state."

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Coming Meetings

National Electrical Manufacturers' Association — Midwinter meeting, New York headquarters, Jan. 19-23. A. W. Berresford, 420 Lexington Ave., New York.

American Institute of Electrical Engineers — Winter convention, New York, Jan. 26-30; district meeting, Pittsburgh, March 9-13. F. L. Hutchinson, 33 W. 39th St., New York.

North Central Division, N.E.L.A.— Commercial meeting, Nicollet Hotel, Minneapolis, Jan. 26 and 27; engineering meeting, Minneapolis, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Pacific Coast Electrical Association— Commercial Section, Los Angeles, Feb. 5-6. S. H. Taylor, 447 Sutter St., San Francisco.

Midwest Power Engineering Conference—Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

Public Utility Group, National Association of Purchasing Agents— Statler Hotel, Boston, Feb. 19 and 20. G. A. Renard, 11 Park Place, New York.

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association — Springfield, Ill., March 12 and 13. G. W. Schwaner, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Northwest Electric Light and Power Association — Engineering Section, Wenatchee, Wash., March 18-20. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Southeastern Division, N.E.L.A.—Vinoy Park Hotel, St. Petersburg, Fla., April 1-3. C. M. Kilian, 508 Haas-Howell Bldg., Atlanta, Ga.

Maryland Utilities Association—Lord Baltimore Hotel, Baltimore, April 10. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

Missouri Association of Public Utilities —Excelsior Springs, Mo., April 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

Southwestern Geographic Division, N.E.L.A.—Mineral Wells, Tex., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Electrochemical Society — Hotel Tutwiler, Birmingham, Ala., April 23-25. C. G. Fink, Columbia University, New York.

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CEMENT RIDES WHERE WATER WILL FLOW

Trailers carry building material through the finished flume of the Pacific Gas & Electric Company's Mokelumne development to the mixer on the Tiger Creek conduit.

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Federal Trade Board Resumes Utility Inquiry

AFFAIRS OF THE Washington Water Power Company were scheduled to be taken up by the Federal Trade Commission on Thursday morning, January 15, on the resumption of its inquiry into the financial transactions of electric power companies. On Tuesday, January 27, the Alabama Power Company will be reached if the schedule is maintained. The Washington company is a subsidiary of the American Power & Light Company of the Electric Bond & Share group. The Alabama company is an operating unit of the Commonwealth & Southern Corporation group.

Canadian General Electric Company

Modernization Cuts Passage Time in Welland Canal

Electrified lift locks that fill in eight minutes and movable bridges that operate in 1½ minutes will contribute largely to the reduction of passage time in the new Welland Canal. It is estimated that a vessel will pass through the new canal in about eight hours, as compared with 24 hours for the present waterway. There are 21 highway and railway bridges which cross it, all electrically operated. Eight locks are involved. The new canal will be opened officially this spring.

EDITORIALS

L.W.W.MORROW
Editor

Political buncombe punctured

THE row about the Federal Power Commission is political buncombe. Its sole object is to get President Hoover in a defensive position. His prompt and vigorous reproof to the demand of the Senate that he return to that chamber for reconsideration the names of three of the appointees it had confirmed brought the facts into the open and called forth approval of his position in the press of the country. He refused to be a cat's-paw and charged the Senate with playing politics at a time that called for statesmanship.

Publicity and the acts of insurgent senators have focused upon the Federal Power Commission a degree of attention utterly out of proportion to its importance. This commission has jurisdiction over a small part of the national power supply, and its work is specified rigidly by laws that have existed for more than ten years. It is a small bureau with practically clear dockets and should not be magnified into an important federal department whose decisions are fraught with enormous public or economic values. The electrical industry has supported and will support the Federal Power Commission in its work as an impartial and competent governmental authority. It does not seek to influence its policies or the appointments on its staff. All that it asks is that the commission be manned by competent and impartial men whose decisions will be made in accordance with the legislation that established the body.

The newly appointed members of the reorganized commission are not all familiar with water-power questions or with the work they have taken up. The chairman has a splendid background of experience to enable him to pass competent opinions on water-power development, but the other members are inexperienced in this subject. Several were appointed for political reasons. The first act of the new commission was to discharge bickering subordinates—a businesslike move. Time should be given for the board to build its staff and act upon matters that come before it before it is subjected to either criticism or approval. It should not be made a political football at the start, and the public statement of President Hoover should encourage its members to go forward courageously. Public confidence and industry confidence will depend upon its acts and not upon external political agitation.

Favorable security market essential

UTILITY financing for 1930 amounted to $1,587,853,841 at an average yield of 5.6 per cent. Bonds and debentures accounted for 80 per cent of it. This enormous total of financing is necessary to raise capital and for refunding. It is the basis for utility expansion programs.

What are the market prospects for this year? This is the most important consideration facing utility executives. It has a large bearing on earnings, on rates and on the growth of the industry. At present investors are reluctant to buy anything but gilt-edged securities. Bonds and debentures of operating utility properties are in demand at reasonable yields; but holding and investment utility company securities acquired by speculative interests because of stock and conversion rights came back into the market in 1930 faster than they could be absorbed by investors and thus sold out of line with their true investment values. This condition still continues, and in addition there is a very slack demand or market for junior securities of any industry.

No valid business reason exists for this security market situation. The utilities made net earnings in 1930 that compare favorably with those of 1929. The business expectations for 1931 are very promising. The past record of the industry for stability and earning power is unsurpassed. It is evident, therefore, that the present restricted utility security market is a part and parcel of the whole market situation. The psychology of investors must change before the market conditions will change, and when this occurs—and there is every reason to expect that it will come about in the near future—the utilities will be one of the first industry groups to find a ready market for both senior and junior securities.

Changes in construction methods

IN TIME of peace prepare for war. The peace is that tranquillity which attends the present slow pace of business. The war will be that resumed on the costs of plant expansion that will accelerate again when general business recovers its stride. During the present lull studies are in progress everywhere to discern wherever possible the means of reducing installation costs of plant extensions. Not by any means least of these are the additional feeders, tie lines and distribution trunks.

In this field it should be made certain that the labor element will not be overlooked. This is especially true of the manner in which construction gangs are organized, based, subdivided and distributed. Conditions in many respects have changed from those which obtained a few years ago and the former crew organizations no longer suffice.

There may be cited such items as the greater weights of treated poles; cross-arms have grown longer and heavier with greater spacings and separations; conductors in many instances run to larger sizes. The insulators are not necessarily heavier, but accessory arcing horns and the hardware have tended to increase weights. Dead-end and angle construction is more rugged, and the longer spans employed in an effort at economy of materials introduce greater tensions and more difficult handling. Rights-of-way are often wider and involve more clearing.

Most of these transitions constitute obstacles to the effective and economical use of crews of small size unless power equipment has compensated wholly for the increased manual labor demanded. After insuring economy in design and materials there is still the opportunity to apply the human power more advantageously and build more miles per season by reapportioning unit groups in the light of the new tasks.

Economic analysis of St. Lawrence power

WHEN the St. Lawrence Power Development Commission was appointed by Governor Roosevelt the question was raised in these and in other editorial columns whether the result would be an impartial economic analysis or an aggrandizement of the political ambitions of its members and its sponsors. The confidence was expressed that should the recommendations be based on the economics alone there would be no doubt about the unfeasibility of a state-owned and state-wide distribution system.

Now comes the report of the commission's marketing board just in advance of the report of the main body of which it is a component. It is gratifying to note that the hopes of impartial observers have been realized. The marketing board says the power can be transmitted economically to New York City, "but the economic benefits would be less than for other points of delivery in the state on account of the great length of transmission lines."

The marketing board recommends that a portion of the power be applied to continuous-process industries at or near the power site and that the balance be integrated with the power already developed and being distributed over existing systems. The board also scotches the notion that ridiculously cheap power for domestic customers can be obtained from the St. Lawrence, stating that the 15 to 25 per cent load factor of such customers would raise the switchboard cost of their consumption to nearly one cent and the addition of transmission, conversion and distribution expense would eliminate the possibility of the low domestic rate proclaimed by the exponents of a state-owned network. In fact, the resulting costs and charges "would be higher than those for

steam-electric production" at or near the domestic markets.

Here, then, we have an admirable admission of the potency of economic factors in dispelling political fantasies. All that can be hoped is that the report of the commission itself, which was about to be made public as the ELECTRICAL WORLD went to press, will likewise adhere to the facts and ignore the fancies.

I.E.C. promulgates new electrical units

MOST of the mild confusion which has surrounded the magnetic units is destined to vanish. Revised definitions, new terminology and a clarification of concepts have emanated from the International Electrotechnical Commission. It now merely remains to adopt and apply these advances, gradually but consistently, in day-by-day practice.

As most of our readers are aware, the I.E.C. is a permanent international body which has been in continuous existence since 1906 as the result of resolutions taken by the International Electrical Congress of St. Louis in 1904. Seven of its twenty-seven general meetings, including the latest in Scandinavia in July, have been plenary meetings, at which the work of the advisory committees has been collated and adopted.

Recognizing the unsatisfactory status of the magnetic units, a special sub-committee was appointed at the Bellagio plenary meeting of 1927 to consider a recommendation from the Italian national committee for a new unit of magnetic flux in the practical or volt-ampere-ohm system of international units. Dr. A. E. Kennelly was the chairman of this subcommittee. Several national committees took up the matter and an American subcommittee made definite proposals, all resulting in the vote in favor of the units and unit names published in this issue. These resolutions were unanimously adopted by the plenary I.E.C. meeting at Oslo on July 9, 1930.

As is the case with all the pronouncements of the international body, no abrupt effect is to be expected from these changes. They are essentially fundamental to the orderly and unified progress of an art and a science based, as hardly any other is, on rigid conformity to standards and measurements of high precision founded on an assembly of absolute units.

Interest in illumination swells society membership

WHEN a long-established, steadily growing membership like that of the Illuminating Engineering Society leaps upward by 21 per cent in such a year as that just past, without high-pressure efforts to attain the increase, there is assuredly a highly pertinent lesson involved.

Today as never before in recorded history are the people of the world interested in light. Interested in what it can do for them and to them, for light as an architectural medium has changed the workshops, office buildings, theaters, stores and hotels of the world in a few—unbelievably few—years. It has in some instances wholly relegated windows to the Happy Hunting Ground, witness in Philadelphia a store, in Chicago a broadcasting studio, in New York the equivalent of a city block, in Boston the offices of a great corporation. In Fitchburg, Mass., it will metamorphose the character of a new industrial plant. Two-purpose, health and illuminating lighting will have us sunburned while we work. Light, as has so often been told, can increase and improve production, economies, safety and workers' morale; make life more interesting, enjoyable and dynamic, and yet it stands but on the threshold of its ultimate achievements.

Tomorrow night, whether indoors or out, is likely indeed to be all but as bright and physiologically satisfactory as is day. New types of diffused sources need but further development to revolutionize the art once more, and health by wire is to have a standing far removed from quackery. Small wonder indeed that the Illuminating Engineering Society grows apace; it would be the greater wonder if it did not do so. Here as ever, though, do growth and success bring their obligation to return to the membership and to the industry greater value than ever before. The field is wide and growing so fast that the whole situation must be thrown wide open for the development of the best in the old and the encouragement of all the possibilities of the new.

Peak Capacity at $24 per Kw.

Obtained by discontinuing steam extraction from bleeder turbines during peak loads and feeding boilers from hot water accumulators

By A. G. CHRISTIE* and WARREN VIESSMAN†

Johns Hopkins University

TEN to 22 per cent increase in capacity of bleeder turbines can be obtained for two-hour peak loads with good over-all economy by investing only $24 per kilowatt of additional capacity.‡ This is done by discontinuing steam extraction during peak loads, diverting the condensate to a surge tank, supplying boiler feed from hot-water accumulators, and increasing generator cooling.

Other methods of holding down the investment to meet maximum demands include use of old stations, pumped storage, Diesel engines, steam accumulators, increased generator cooling and preheated standby turbines. These methods are discussed briefly to show their relationship to the new proposal which is presented in more detail with the results of economic studies.

With the growth of the electrical power industry new plants of more modern design and greater economy have been built, resulting in the older plants becoming uneconomical for continuous operation as compared with the later installations. In many cases the old plants have been dismantled to make room for new installations. In other cases the older stations have been retained for use as peak-load plants during the daily or seasonal peak loads. This method of supplying peak-load capacity has the disadvantage that the peak load is not generated as efficiently as the base load. However, as the value of the older plant is generally written down to a low figure, the plan has certain financial advantages in small fixed charges for such peak-load capacity, while the higher fuel consumption for short peak-load periods is not a significant factor in the total system costs.

The use of hydraulic storage is another method of supplying peak loads and will doubtless meet with success under favorable conditions. This method has been utilized in Switzerland, Germany and Austria during the past few years. One of the latest installations is in connection with the Herdecke super-power station in the Ruhr district of Germany.[1] With this method water at low head is pumped into high head storage reservoirs during the off-peak hours and is utilized in carrying peak loads. Pumped storage has been used in this country at the Rocky River hydro-electric development of the Connecticut Light & Power Company, near Milford, Conn. This installation is 79 per cent efficient when utilization of pumped storage in Stevenson plant is included; that is, for every 100 kw. consumed in pumping the water from low head to high head 79 kw. is returned in electrical energy through the generators. When figured from potential water power at low head furnished to the turbines driving the pumps, to kilowatt output from peak-load generators, the European plants usually average

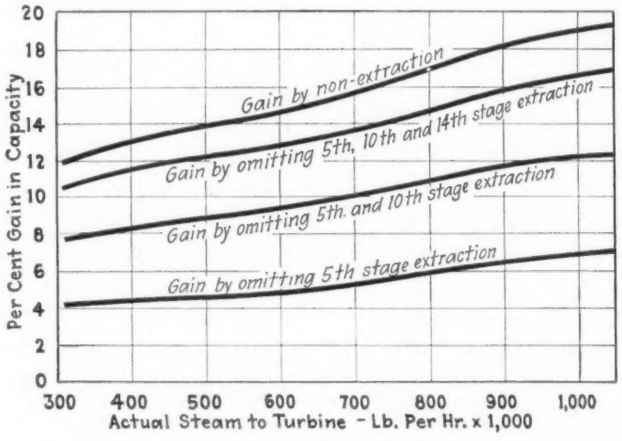


Fig. 1—Turbine capacity increase by omitting stage extraction

Based on 94,000-kw. turbine with four bleeder heaters operating at 400 lb. steam pressure, 725 deg. F. steam temperature and 28.5 in. vacuum.

**Professor of mechanical engineering. †Graduate student mechanical engineering.*

‡Based on paper presented before Metropolitan Section, N.E.L.A.

[1] *"Der Entwicklungsstand der Speicherpumpen," by W. Hahn, VDI, June 21, 1930, page 881.*

about 60 per cent efficiency. The value of such hydraulic storage in America is doubtful. Interconnection and the rapid growth of power consumption provide a need in a few years for all power that was earlier available for pumping into storage.

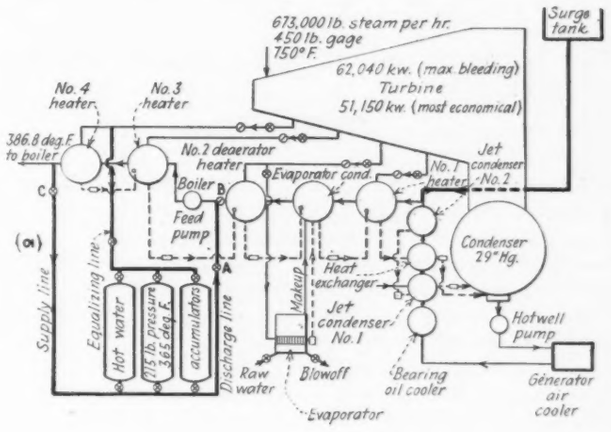
Another method which in recent years has become of increasing interest is the utilization of Diesel engines for peak-load capacity in conjunction with steam or hydroelectric central stations. The installation of the 10,000-kw. Diesel engine generators at Hamburg, Germany, and of two 7,500-kw. Diesel generator sets at Heningsdorf, near Berlin, are the largest of such plants now in operation. This type of peak-load plant has advantages for isolated locations, and particularly near the end of long feeders.

Steam accumulators afford another method of carrying peak loads. Steam can be generated with a standard boiler plant at a uniform rate during the day, and during periods of light load excess steam is stored in an accumulator. The stored steam is utilized during peak loads in driving a special turbo-generator which operates at variable inlet pressure. This method of operation has the advantage of flexibility and is economical in fuel consumption. The most outstanding installation is the

Figs. 2a, b and c—Arrangements for increasing peak capacities of bleeder turbines without feeding cold water to boilers

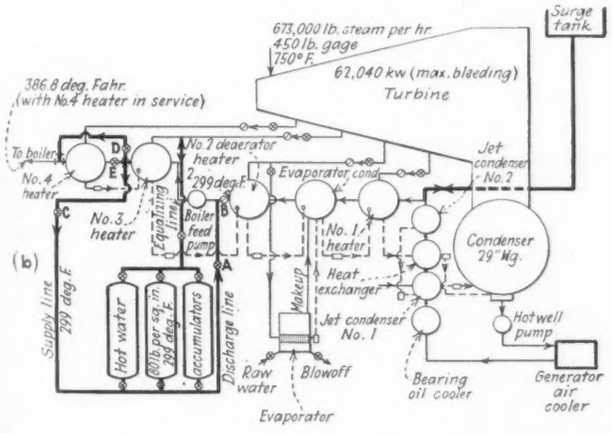
Based on temporary discontinuance of bleeding, diversion of condensate to surge tank, and feeding boilers from hot-water accumulators. The equipment emphasized is all that is added to the ordinary bleeding facilities for increased capacity.

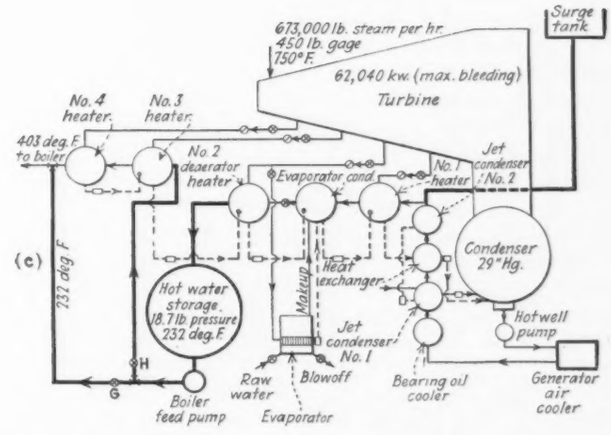
(a) Normally the accumulator tanks are full of water which is heated by circulation through the fourth bleeder heater so the water has approximately the same temperature as the steam from heater No. 4. When the load exceeds the maximum capacity of the turbine when bleeding, valve *A* is manually or automatically opened. The water pressure in the accumulators exceeds that from the condensate pump at the inlet to the boiler feed pump and causes the check valve *B* on the regular feed line to close automatically. The feedwater from the accumulators leaves the boiler feed pump and passes through the third and fourth bleeder heaters at the temperature at which it normally leaves the fourth bleeder heater. Hence no steam is drawn from the turbine shell to heat the feed in these two heaters and they act as though they were cut off from the turbine. When valve *B* closes the flow from the condensate pump can no longer pass through the



LEGEND

• Check valve • Hand or automatic control valve ▭ Trap





first and second bleeder heaters, but passes directly to the surge tank. With no water flowing through these two heaters, no steam is withdrawn at the corresponding two bleeder points and the two heaters are virtually cut off from the turbine. Therefore the steam that would normally be bled to all the heaters passes through the turbine to the condenser, substantially adding to turbine output, with no added flow of steam at the throttle.

When the turbine load falls below full capacity (bleeding) bled steam to the four heaters is utilized to heat not only the condensate from the condenser at that load, but also a portion of the excess condensate which was stored in the surge tank during the peak-load period. This excess supply of hot water above boiler feed requirements is utilized to fill the hot water accumulators through valve *C*. The rate of heating this excess water is adjusted by valve *C* so that sufficient steam is bled during this charging period from the bleeder points to place an efficient load on the boiler plant and also so that the turbine operates at approximately its most economical rating. Other charging rates could, of course, be utilized if necessary.

(b) When the accumulators are drawn upon for peak-load service valve *D* is opened and valve *E* closed, thus by-passing No. 4 bleeder heater. If the feed from the accumulators was allowed to pass through No. 4 bleeder heater the normal amount of steam would be bled to heat it to 386.8 deg. F. at peak load, and this withdrawal of steam would seriously diminish the peak capacity of the turbine.

(c) At the time of peak load valve *G* is opened and valve *H* closed, thereby bypassing the third and fourth bleeder heaters. Valve *F* is closed, thus putting the first and second bleeder heaters out of operation. Feed pump conditions would be normal throughout, so that no change in water inlet pressures would occur as in the preceding schemes.

50,000-kw. Ruths accumulator at the Charlottenburg power station of the Berlin Municipal Electricity Works. Performance data on this plant have been recently published.[2] The economics of the application of such accumulators to American practice were fully discussed in a recent paper before the A.S.M.E.[3]

The station investment to carry peak loads received much attention at the World Power Conference at Berlin last summer. Sir Charles Parsons and Robert

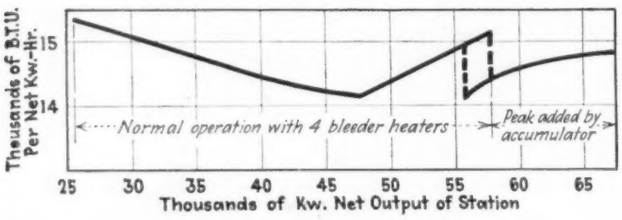


Fig. 3—Performance of turbine bleeding and non-bleeding with hot water accumulators feeding boilers

Dowson discussed the possibilities of securing additional peak-load capacity from a turbo-generator by providing bypass valves in the turbine. They proposed to use standard generators provided with the usual generator air coolers supplied either with condensate or cooling water from the circulating water supply. At the time of peak load the generator air would also be passed through secondary coolers furnished with refrigerated brine, which at peak loads would cool the air to 41 deg. F. instead of to 86 deg. F., as is usual with the standard air coolers. This would enable the generator output to be increased about 20 per cent during peak loads. The authors estimate that the first cost of such a plant, including refrigerating equipment, would only be about 50 per cent of that to provide peak-load plant in the usual way.

Eric Brown, of the Brown Boveri interests, pointed out that it takes from six to sixty minutes to get a cold turbine up to operating speed when it is needed. This detracts from the ability of a power station to respond immediately to rapid changes in power demand and to emergencies. For this reason more turbo-generators are frequently maintained in operation than required by the normal power demand in order to meet these conditions, and the efficiency of the power stations suffers in consequence. Mr. Brown proposed a method for keeping the stand-by turbine heated to service temperatures and hence available for instantaneous starting when needed. This is done by placing an insulated casing a foot or so from the turbine casing and circulating through this space air preheated to the saturated temperature of the steam, or even at a higher temperature. The air is heated by suitable electric resistance heaters thermostatically controlled to provide the desired temperature. The turbine is thus maintained at operating temperature and can be started immediately with no fear of distortions, such as may occur in warming up a cold unit. This system has been tried on some commercial units in Europe. The heating requirements have been found to be equivalent to about 5 per cent of the steam required to keep the turbine at speed with no load. Such a system would make stand-by units instantly available for service, but would not decrease plant investment.

In this country there has been general acceptance of bleeder type, turbo-generator units, steam from which is extracted at several points and utilized for heating the feedwater. High-temperature feedwater is obtained economically in this manner, but at the same time the turbo-generator capacity is reduced below that possible of attainment with complete expansion without bleeding. This suggests the idea that increased turbo-generator output might be obtained during peak loads by temporarily shutting off the bleeder heaters and permitting the total steam flow to pass through the whole turbine to the condenser. That excess power is available and can be obtained in this way has been demonstrated by trials made at Gould Street station, Baltimore; Long Beach station, Los Angeles, and Lakeside station, Milwaukee, where increased capacity was secured by cutting off certain of the bleeder heaters.

However, certain problems are introduced by shutting off the bleeder heaters. Colder feedwater must be supplied to the boilers and when all heaters are cut off; this feed will be at condensate temperature. This increases the heat per pound that must be supplied by the boiler and therefore increases the rate of firing. The furnishing of cold feedwater is not good practice, as it increases stresses in feed lines and in boiler shells. However, if there is no objection to cold feedwater and to further overloading the boiler and furnace substantial increases in peak-load capacity can be obtained by shutting off the bleeder heaters.

These considerations indicate that any method which could be developed to discontinue bleeder feedwater heating at the time of peak loads without necessitating the use of cold feedwater for boilers deserves careful consideration as a desirable means for carrying peak loads of relatively short duration. Three methods based on the same principle are shown in Fig. 2 a, b and c.

The simplicity of the system shown in Fig. 2a is emphasized by the fact that the only operation required is that of opening valve *A*. All other events are automatic in their nature. It is even possible to provide a control at valve *A*, which will automatically open it when

Table I—Results With and Without Bleeding

(See Fig. 2a)

*The "compensated" figures indicate the station rate during peak load with the accumulators discharging, but with calculated allowances included for the extra heat required from added bled steam to heat the water on its way from the surge tank to the accumulators at other times and at loads less than maximum capacity during the charging periods of the accumulators. The accumulators are assumed to be recharged over an eight-hour period, twice as long as discharge period.

Normal Operation (bleeding)				
Net station output, kw	57,630	48,200	36,900	25,060
Over-all station performance, B.t.u. per kilowatt-hour	15,130	14,150	14,750	15,330
Peak Operation (bleeding discontinued); accumulators discharging				
Net station output, kw	67,825	61,655	57,645	55,800
Over-all station performance with accumulators discharging, B.t.u. per kilowatt-hour	12,900	12,770	12,470	12,210
Compensated* station performance for accumulators discharging, B.t.u. per kilowatt-hour	14,875	14,695	14,385	14,420

[2] *"Untersuchungen an einer 50,000 kw. Ruths speicheranlage," W. E. Wellman, VDI, June 7, 1930, page 743.*

[3] *"The Peak-Load Problems of Steam Power Stations," A. G. Christie, "Transactions A.S.M.E.," Vol. 51, No. 12, 1929.*

Table II—Added Plant Cost Caused by Hot-Water Accumulators

Three accumulators, each of 8,480 cu.ft. capacity	$110,000
Foundations for accumulators	15,600
Insulation for accumulators	10,000
Additional valves, piping, and pipe covering	15,900
Cost of enlarged surge tank	16,600
Cost of 10,000 kw. of increased generator capacity and cooling system at $5 per kilowatt	50,000
Engineering and overhead expenses at 15 per cent	32,400
Total	$248,400

the generator load, or as an alternative when a certain stage pressure, reaches a predetermined amount. Thus, with a standard, modern installation and with the addition of a few insulated tanks, piping and valves for hot water storage an enlarged surge tank, and the utilization of generator reserve capacity either provided at the time of installation or by supplementary generator air cooling if necessary, a simple method of obtaining peak-load capacity for short periods is secured with a minimum of equipment.

Economy of modified bleeder operation

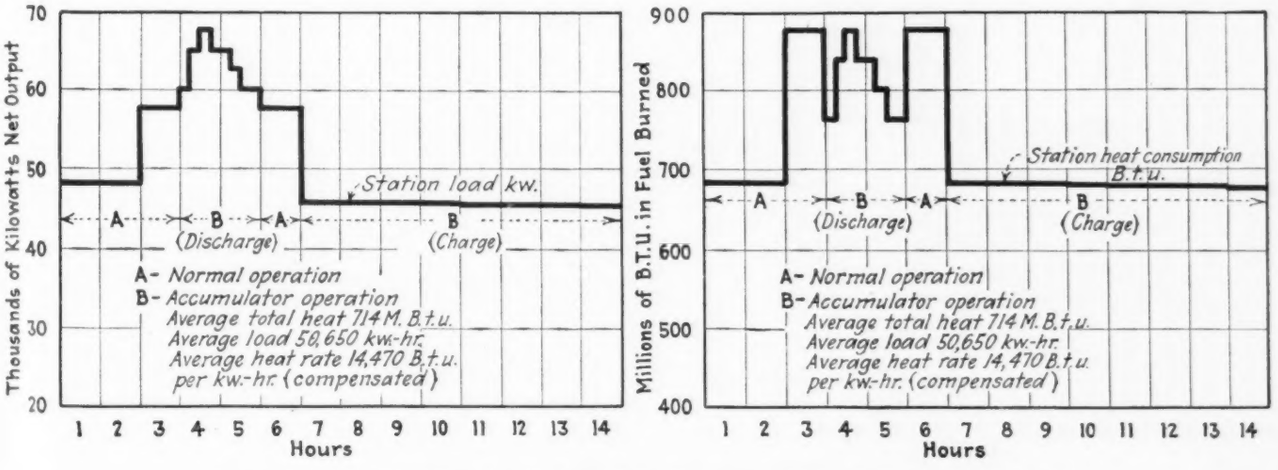
Heat-balance calculations have been made for an installation like that in Fig. 2a, having a maximum output of 62,040 kw. and a most economical loading of 51,150 kw. with all bleeders in normal service. Air preheating to 400 deg. F., with forced and induced draft fans, was assumed with powdered coal for a boiler plant consisting of three boilers each of 23,000 sq.ft. of heating surface operating at 84 per cent efficiency when delivering the maximum steam required. The net station output at maximum capacity is 57,630 kw. and 48,200 kw. at most economical load, after allowing for all station auxiliary requirements. Table I and Fig. 3 show the station heat rates for normal operation without accumulators, and for peak-load operation with accumulators designed for two-hour peaks of rectangular form.

Naturally the total duration of the peak load that may be carried is governed by the storage capacity of the accumulators. For a two-hour peak three accumulators of 8,480 cu.ft. capacity each have been provided for this plant. They would be 12 ft. in diameter, with hemispherical ends, and 80 ft. long. They are of sufficient size to store the 1,366,000 lb. of feedwater required for operation of the plant at full peak-load capacity for two hours. These accumulators were estimated for installation out of doors with 5 in. of insulation and with an outside sheet metal covering. Increased surge tank capacity of approximately 22,000 cu.ft. was assumed to be provided within the plant.

To provide capacity for a 67,825-kw. peak continuously for a period of two hours the estimated investment shown in Table II would be required. These figures are believed substantially to represent actual costs. Should a continuous, sustained peak of 67,825 kw. not be required for two hours, smaller accumulators could be used, and the investment cost would be decreased. If peak loads last longer than two hours, more or larger accumulators would be needed at an added cost.

This investigation reveals that a modern station having a net maximum output of 57,630 kw. (bleeding) with a heat consumption of 15,130 B.t.u. per hour could carry a peak load of 67,825 kw. for two hours at a compensated heat rate of approximately 14,875 B.t.u. per kilowatt-hour after the installation of hot water accumulators, increased generator cooling and the necessary piping and equipment. This addition of 10,195 kw. peak-load capacity represents an increase of 17.7 per cent in net station capacity and can be obtained for a two-hour peak at an investment of approximately $24.36 per kilowatt of added capacity, compared with $90 to $100 per kilowatt, the average cost of a standard modern station of this size. The use of such equipment would be simple, flexible and as economical as the present maximum capacity of the station, and comparable with average station performance under normal conditions.

Calculations have also been made for a plant of similar capacity and arrangement, but with five bleeder heaters producing a final feedwater temperature of 403 deg. F. instead of 386.8 deg. F. at maximum load. With the addition of the fifth heater, 56,595 kw. net station output could be obtained as the maximum normal loading with a heat rate of 15,200 B.t.u. With the accumulator on discharge a net station load of 68,620 kw. could be carried at the time of peak load with a compensated heat expenditure of 14,820 B.t.u. Therefore, with the fifth



Figs. 4 and 5—Hypothetical station load curves and results of using hot-water accumulators during peak loads

heater, an increase of 12,025 kw., or 21.25 per cent, in net station capacity was obtained in the peak load that could be carried over that possible with a five-bleeder heater installation without accumulator storage.

Calculations were also made to determine the per cent increase in peak-load capacity that could be obtained with a similar plant if it were provided with only three bleeder heaters. In this case the feedwater was heated to 317.1 deg. F. at maximum load. With three bleeder heaters the maximum net station output of 61,730 kw. would be obtained with a heat expenditure of 15,130 B.t.u. per kilowatt without accumulators. With accumulators, a net station capacity of 67,970 kw. could be obtained for peak load with a compensated heat expenditure of 15,060 B.t.u. kilowatt-hours. This is an increase of 6,240 kw., or 10.1 per cent, in the peak capacity by the use of accumulators over that to be obtained by a three-bleeder heater installation without accumulators.

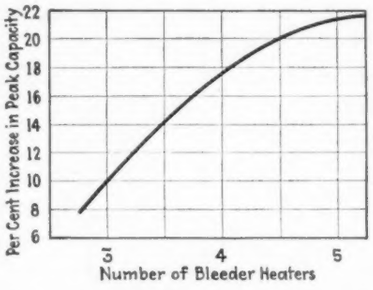


Fig. 6—Effect of number of bleeder heaters on peak-load capacity with accumulators

In each case the economies of operation, which include all radiation and heat losses, are substantially as good with the accumulator as they would be without the accumulator installation after allowing for recharging the accumulator. The peak load to be obtained above the maximum capacity of the normal plant is, with the cases considered, 10.1 per cent for three heaters, 17.7 per cent with four heaters and 21.25 per cent with five heaters. Furthermore, these gains are secured with no increase of boiler or furnace ratings over those with all bleeders in operation.

Justification of the last heater depends upon the amount by which the fuel saving as represented by the improved heat rate exceeds, at the given load factor, the fixed and operating costs of the heater. With the utilization of hot water storage, it is probable that an additional heater may be warranted on the basis of the additional low-cost peak-load capacity that may be secured through its use. In new station designs it is quite probable that the use of five bleeder heaters in conjunction with hot water accumulators will be employed to an increasing extent to provide such low cost peak capacity.

The scheme of hot water storage considered so far requires that the accumulators be built for a steam pressure of 215 lb. per square inch gage to store hot water at 365 deg. F. The cost of accumulators may be reduced if this storage can be provided at a lower pressure. This can be done in either of two ways (Fig. 2 b and c), provided boilers and furnaces can be overloaded beyond the capacity required with all bleeder heaters in service. In Fig. 2b the accumulators need be built for a steam pressure of only 80 lb. and those in Fig. 2c for 18.7 lb.

With the arrangement shown in Fig. 2b the net station output when the accumulators are discharging would be about 67,770 kw., an increase of 17.5 per cent over full bleeding conditions. The accumulator water will pass to the boiler at 299 deg. F., requiring an increase of boiler rating and of fuel burned of approximately 8.6 per cent.

With the arrangement in Fig. 2c the net station output at maximum capacity with the accumulator discharging would be about 67,670 kw., equivalent to an increase of 17.4 per cent over maximum capacity with all bleeders in service. The feedwater now passes to the boiler at about 232 deg. F., which would require an addition of 15.4 per cent to the boiler capacity and to the coal burned. This, however, is not a serious consideration, for if it is assumed that the boilers operate at 304 per cent rating with full capacity of 57,630 kw. with all four bleeders in service they will now be operated at 352 per cent rating at maximum peak load of 67,670 kw. with water storage after No. 2 bleeder heater. Peak loads are assumed to be of short duration, and hence this increased rating of boilers is not excessive.

Considering these three schemes of using hot water accumulators, the gain in peak-load capacity is substantially the same, i.e., 17.5 per cent, whether the accumulators are placed after No. 4, No. 3 or No. 2 bleeder heaters. The boilers and furnaces, however, operate at the same ratings with or without accumulators in service when placed at No. 4 bleeder heater, but at increased ratings in the other positions.

Several other schemes have been suggested to provide hot feedwater when the bleeder heaters are cut off during peak loads. One interesting suggestion is the use of diphenyl-oxide. A large reservoir of diphenyl-oxide would be heated by a heater in the flue gases and stored at moderate pressure. The feedwater on its way to the boiler would be heated by diphenyl-oxide circulated through a feedwater heater during peak loads when bleeder heaters are shut off. No surge tank or water storage need be provided with this system as the condensate can go direct to the boilers through the diphenyl-oxide feed heater.

A considerable gain in unit capacity may be secured by cutting off No. 4 bleeder heater only. Computations indicate that the peak-load capacity will be increased about 6 per cent by this method, while the boiler rating and fuel consumption will be increased about 7 per cent. If both No. 4 and No. 3 bleeder heaters are cut off the peak-load capacity will be increased about 11.8 per cent, with an increase of boiler rating of approximately 14 per cent.

These methods give substantial increases in peak-load capacity at a small sacrifice in station economy. The interesting point is that their use involves no additional cost provided the generator can carry the added load. Additional cooling in the generator would not be expensive. Such methods can be used advantageously at the time of peak load in almost any modern plant with three or more bleeder heaters.

The utilization of hot water storage in accumulators for peak loads requires a low investment, is simple and reliable in operation and is economical in fuel consumption. Its performance is comparable with the heat rate of a modern station with bleeder heaters of normal design at maximum output. The hot water accumulator method requires little special equipment and its simplicity of operation indicates that its application should meet with success in installations where peak-loak capacity must be provided at minimum cost and where large boiler and furnace overloads are not desired.

Electrical Units Given New Names

It may not be long before a new set of electric and magnetic terms and units will be in common use. New labels will also appear ultimately on meters and instruments. This will be the result of action taken by the 1930 plenary assembly of the International Electrotechnical Commission in Stockholm. The results are of special interest to Americans because the changes adopted were very largely those which were advocated by the American committee under the chairmanship of Dr. A. E. Kennelly.

The c.g.s. units which have stood since the Paris Congress of 1900 were subjected to revision and new names of units promulgated for the practical volt-ampere system. The changes in the absolute (c.g.s.) units are founded on the hypothesis that $\mathcal{B}$ and $\mathcal{H}$ in free space have different physical dimensions, so that their ratio, μ_o the space permeability, becomes a dimensional quantity and no longer is conventionally to be viewed as the mere numeric unity. Permeabilities of magnetic substances are henceforth to be viewed either as absolute permeabilities (μ) with dimensions or as relative permeabilities (μ/μ_o) with pure numeric values. With this concept adopted the next move was to assign specific names to the four more commonly used magnetic units and also a name for one of their counterparts in the practical system:

Quantity	Symbol	C.g.s. Unit Name
Magnetomotive force	$\mathcal{F}$	gilbert
Magnetizing force	$\mathcal{H}$	oersted
Magnetic flux	Φ	maxwell
Magnetic flux density	$\mathcal{B}$	gauss

This is a departure from common American practice of attaching Oersted's name to the unit of reluctance. The Danes regarded this as an anomaly because Oersted discovered the magnetic field produced by an electric current and had not interested himself particularly with reluctance.

For the present the prefix "pra" will only be associated with the maxwell to indicate the practical unit of 10^8 c.g.s. maxwells. This is justified because there are recognized at least three different foundations for practical electrical units which would cast doubt on the precise magnitudes implied by the terms pragilbert, praoersted and pragauss. Reluctance, reluctivity, permeance and permeability remain without single names derived from the pioneers.

The reactive-volt-ampere is to be designated the "var," a contraction of the French "volt-ampere-reactif." The common right triangle of vector relations may henceforth be labeled "watts" on the base, "vars" on the vertical side and "volt-amperes" on the hypotenuse. The common American abbreviation of reactive kilovolt-ampere-hours to Rkvah thus is to be altered to "kvarh." The term "reactive power" was not disturbed. Power factor in a steady-state sinusoidal system is derived as the numerical value of the expression

$$\text{Watts}/\sqrt{(\text{Watts})^2 + (\text{Vars})^2}$$

Provisionally the definition of power factor in the general non-sinusoidal single-phase circuit is to be the numerical value of the ratio watts/volt-amperes.

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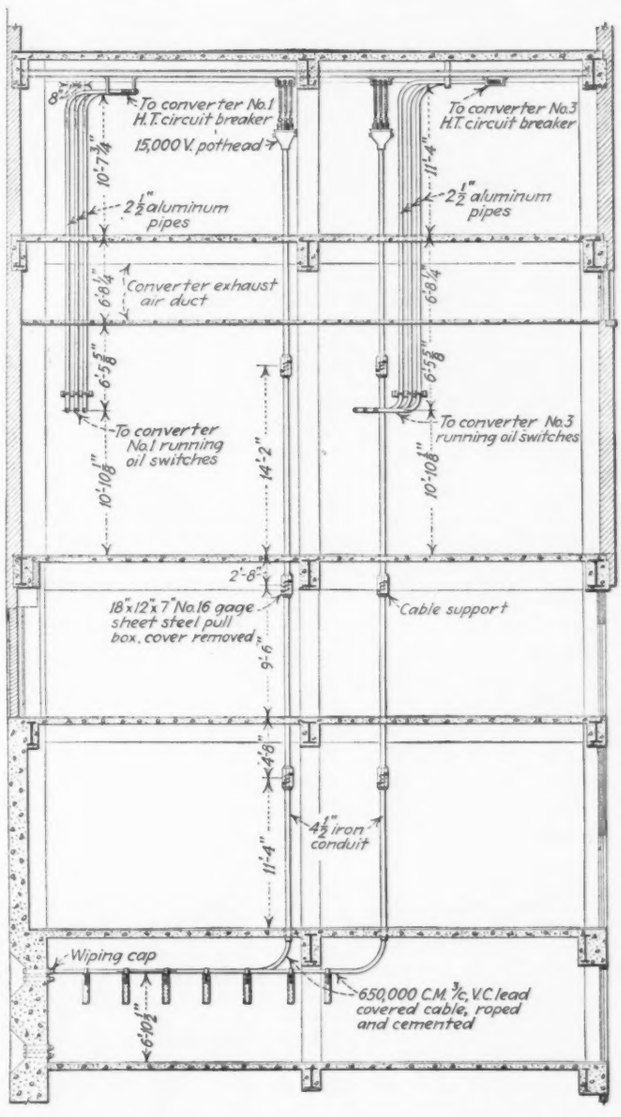
Supporting Vertical Cables in Substations

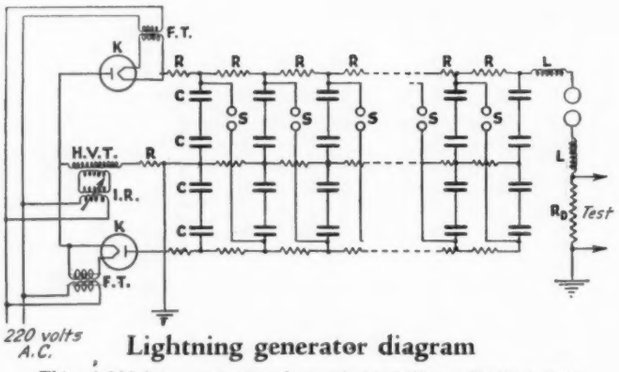

To converter No.1 H.T. circuit breaker
15,000 V. pothead
To converter No.3 H.T. circuit breaker
2½" aluminum pipes
2½" aluminum pipes
Converter exhaust air duct
To converter No.1 running oil switches
To converter No.3 running oil switches
18"x12"x7" No.16 gage sheet steel pull box, cover removed
Cable support
4½" iron conduit
Wiping cap
650,000 C.M. 3/c, V.C. lead covered cable, roped and cemented

Since the 12-kv. switching squipment of the new North Dearborn substation of the Commonwealth Edison Company is located on the third floor it is necessary to run the station supply cables up through the building 65 ft. As shown by this drawing the cables, filled with a non-migrating compound, are contained in 4½-in. iron conduit with three pull boxes in each riser. The cable sheaths are supported in these boxes, but, except for friction of the conductors in the cubic, the weight of the conductors is held by cap nuts on the tops of the pothead terminals. The down leads from the switches to the rotary converters on the floor below are carried singly in 2½-in. aluminum pipe to reduce inductive losses and heating.

Purdue Builds 1,000-Kv. Lightning Generator

By C. S. SPRAGUE

Research Assistant Purdue University, Lafayette, Ind.



Lightning generator diagram

This 1,000-kv. generator has 44 capacitors divided into eleven blocks of four. It is charged effectively at 100 kv., although the charging potential above ground is only 50 kv. The parts as noted in the diagram are: *C*—Capacitors, *R*—charging resistances, *S*—switching gaps, *K*—kenotrons, *F.T.*—filament transformer, *I.R.*—induction regulator, *H.V.T.*—high-voltage transformer, *L*—series inductance discharge, *RD*—series resistance discharge.

FOR some time past the Engineering Experiment Station at Purdue University has been co-operating with the Utilities Research Commission on a project requiring the use of a lightning generator. Some of the data obtained were limited in scope, mainly because the lightning generator first used had an upper limit of only 100 kv. It seemed that about 400 kv. would be sufficient for the present tests. However, since future tests at higher surge voltages were contemplated, a new generator was built for 1,000 kv.

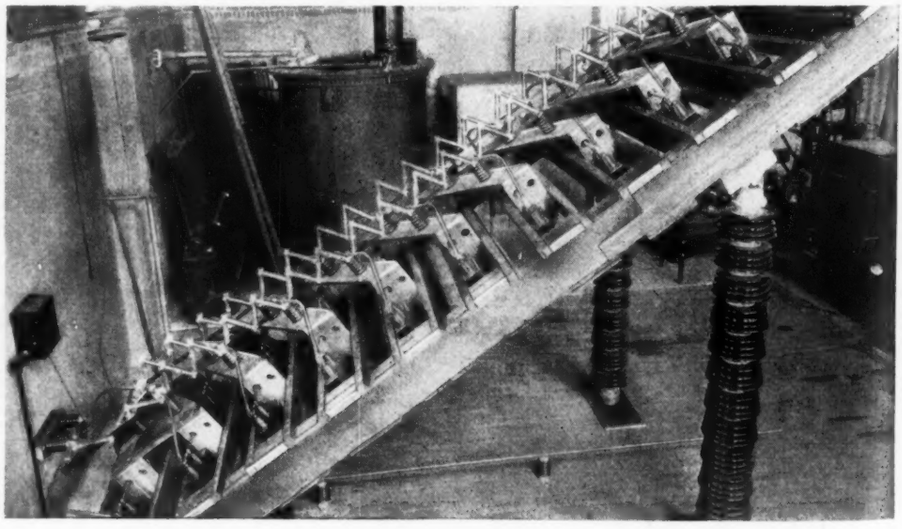
This new lightning generator consists of 44 condensers arranged in eleven parallel banks with four condensers in series in each bank. The eleven banks are charged in parallel at 100 kv. During charge the center connection of each bank of condensers is grounded through a resistance so that the actual charging voltage to ground is only 50 kv. This aids materially in reducing corona and leakage from the apparatus. The individual capacitor units themselves are 0.25-mfd. oil-filled condensers rated at 18 kv. direct current and operated up to 25 kv. Of course, under continued operation at 25 kv. one may expect occasional trouble with the capacitor units; however, in a large part of the testing work it is unnecessary to make use of this upper limit.

Rectified 60-cycle alternating current is used for charging, rectification being obtained by means of two 150,000-volt, 250-milliampere kenetron tubes, having a filament supply insulated for 120 kv. direct current. High-voltage 60-cycle alternating current is supplied to the tubes from a 5-kva., 45,000-volt transformer which has both ends of its high-tension winding insulated. Primary voltage supply for this transformer is obtained through a 5-kva., 200-volt, oil-cooled, manually operated, induction type voltage regulator, with full 100 per cent buck or boost, giving 0-440 volts for control of the charging voltage. This apparatus is all located in a pit below the maple frame work of the capacitor support.

The type of discharge resistance may be more or less optional; no doubt there are many arrangements which

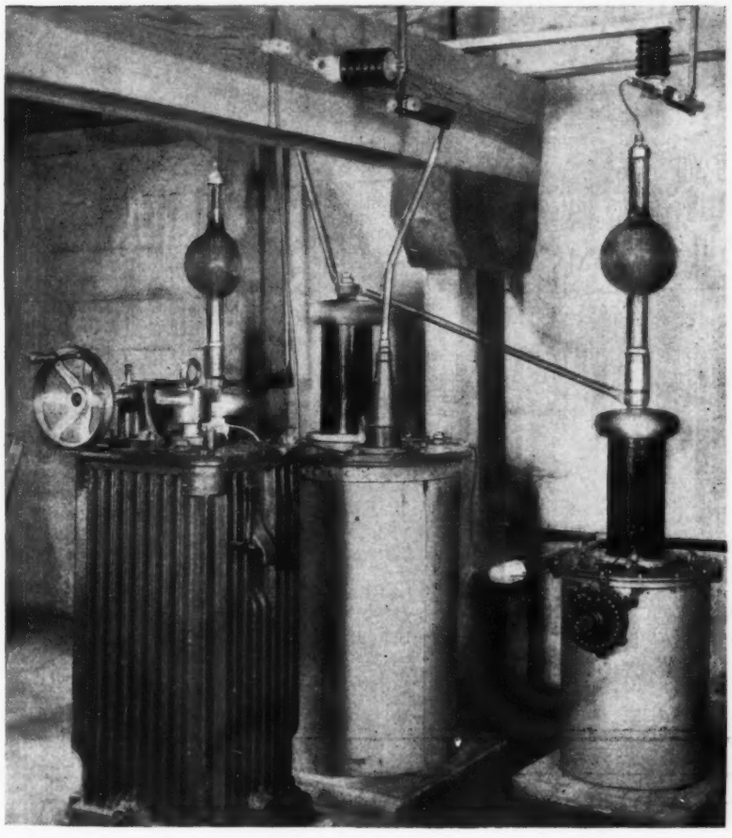
The completed generator

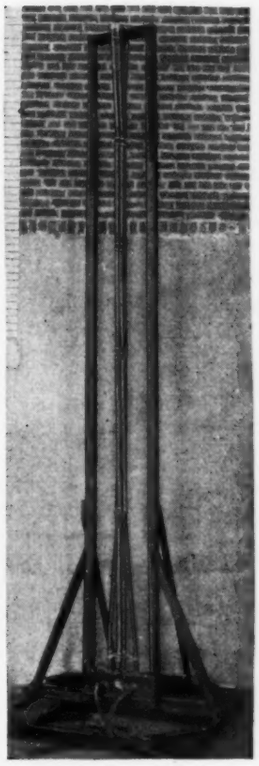
The 44 condensers are supported on a rather large and heavy frame, 20 ft. long by 7 ft. wide, constructed throughout of maple, impregnated by boiling in paraffin. The lower end of the frame rests at floor level, while the upper end is supported, at a height of 10 ft., by two columns of post type insulators. During discharge the low end of the frame is at ground potential and the high end at the total potential of the generator or 1,000,000 volts above ground. In this way the voltage, physical clearances and insulation to ground are kept roughly proportional. The frame also serves as a support for the charging resistors and switching gaps. Wirebound charging resistors are used, giving a total of 200,000 ohms per bank. The switching gaps are composed of 6.25-cm. spheres.



Full-wave rectification

Utilizing both half cycles permits charging at double the voltage to ground.





Water resistance in discharge circuit

Ordinary garden hose with metal couplings at fixed distances makes a simple and easily manipulated water column resistor.

would give satisfactory service. With this lightning generator a water column resistance in a ¾-in. garden hose has been used. A small pump keeps the water circulating and prevents heating. There may be several lengths of hose, in series as far as the water is concerned, but in parallel for the discharge current of the lightning generator. Hose couplings may be inserted at intervals along the discharge resistance for tapping of voltages of different magnitudes. The number of parallel lengths and the conductivity of the water may be varied for controlling the resistance. This has worked out as quite a convenient and flexible type of discharge resistance.

The inductance coil is preferably rather long and of small diameter. While not the most efficient type of inductance, this construction gives low distributed capacity and keeps the volts per turn at a low value. It is usually convenient to have several inductances of different values for controlling the character of the discharge.

The charging outfit is turned on or off by means of a remote-control push-button station. The discharge is initiated by means of a three-electrode and trigger gap arrangement, which discharges the generator at regular intervals and also provides a means of synchronizing a cathode-ray oscillograph with the discharge. An automatic short-circuiting device discharges each of the eleven banks of condensers when the power is taken off the charging outfit. This, with interlocking safety features and a guard fence, minimizes the hazard of operation.

60-65-Ft. Poles Used in Residential Sections

By H. LESTER LIVINGOOD

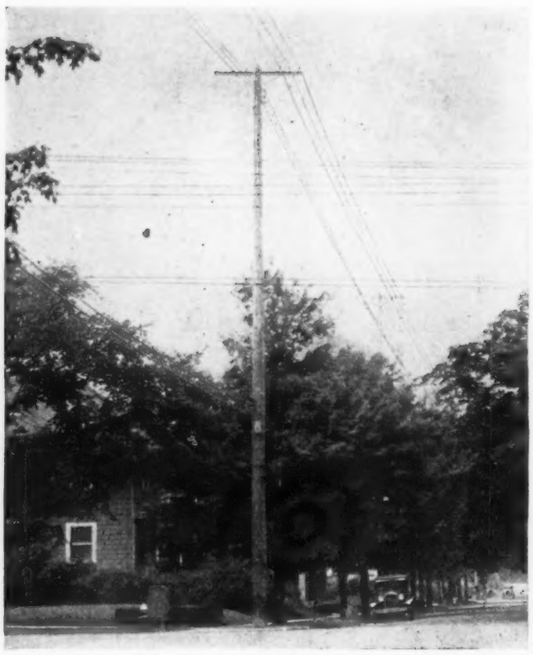
Superintendent Distribution Engineering, Associated Gas & Electric System, Binghamton, N. Y.

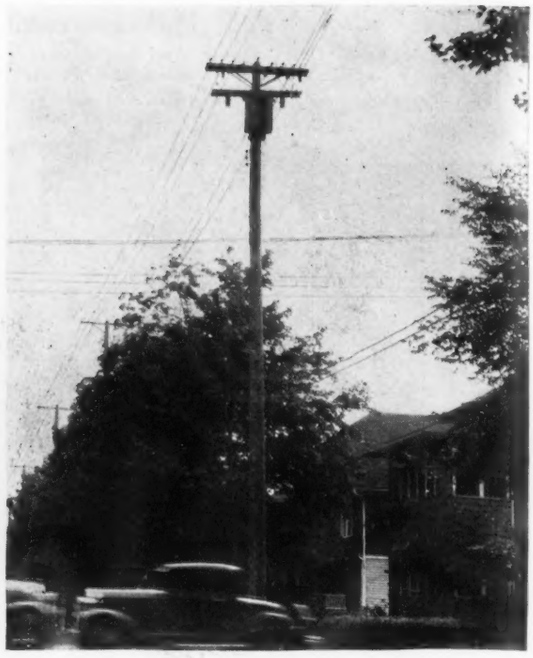
BECAUSE of the abundance of trees in the residential sections of Binghamton, the routing of distribution feeders presents quite a problem. For several years joint use of 40-ft. poles has been shared with the telephone company, but it is forced in many cases to keep its circuits at least 25 ft. above ground to avoid the large Y branches of the trees and at the same time maintain 6-ft. clearance from the secondary power circuits. Since the average tree height is 50 ft., a wedge-shaped tunnel has to be cleared through the foilage and branches of a majority of trees to accommodate the power circuits.

Maintenance of tree clearance is very expensive, wind and rain storms frequently cause tree fires or interruptions to main feeders and line work is made hazardous. Moreover, it is becoming more difficult to secure the consent of property owners to trim trees.

Since 2,300/4,600-volt equipment had been used for quite some time on this property (operated at 2,300

Tall poles avoid tree trimming and circuit troubles





volts), and since an economic study proved that a change to 4,600-volt operation would be advisable to maintain good service, a definite plan of changeover was arrived at. Realizing that a program of this type must be spread over quite a few years, it was decided that as a line needed rebuilding for either electrical or mechanical reasons, main feeders would be erected on 60- to 65-ft. cedars, using No. 2/0 or No. 4/0 copper conductors. On spur primary lines 60- to 65-ft. poles would be staggered; that is, the span for light primary would be 200 ft., while the secondaries should be carried at a lower level and be attached to 35- or 40-ft. poles spaced half way between adjacent high poles, making the secondary spans approximately 100 ft.

This type of construction has now been carried on for a few years and its results are very gratifying. Although our pole maintenance costs within the city were forced up somewhat, the saving effected by continuous service, decrease of trouble due to storms and elimination of a large majority of city tree trimming have greatly offset this increase.

Besides the costs, these tall pole lines are readily adapted to 4,600-volt operation, which insures our consumers good service for some time to come. The telephone company has also noticed a decrease in telephone interference along lines of such construction. Radio interference has been eliminated in many cases. Consent to trim trees at this height is readily obtained as it really shapes the trees and need be indulged in only one-third as often as the wedge-shaped type of trimming.

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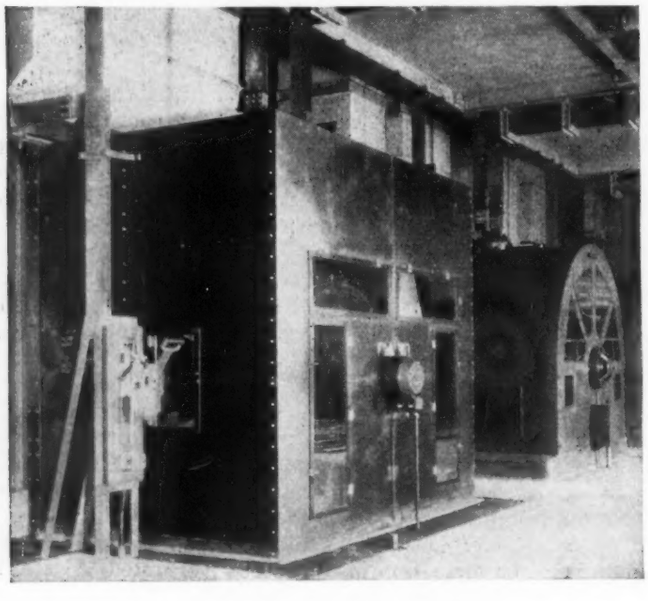
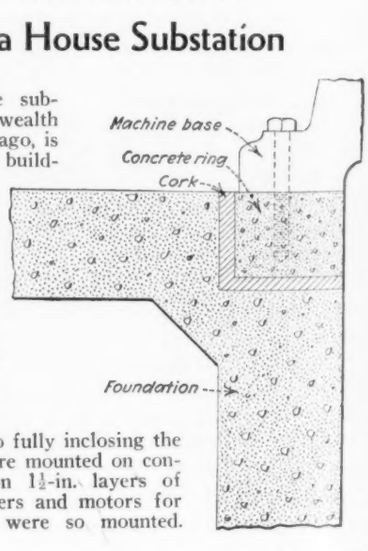


Converters Silenced in Opera House Substation

The Wacker Drive substation of the Commonwealth Edison Company, Chicago, is in the basement of the building that houses the Chicago Civic Opera. To add the continuous drone of synchronous converters to the orchestra and voices was unthinkable and precautions were taken, therefore, to silence the rotaries. Special attention was given to the ventilation housings, and in addition to fully inclosing the machine, the latter were mounted on concrete rings carried on 1½-in. layers of cork. Even the blowers and motors for converter ventilation were so mounted.



A Useless Clause in Pole Specifications

By R. P. A. JOHNSON

Engineer Forest Products Laboratory, Forest Service, U. S. Department of Agriculture*

CERTAIN clauses in specifications have been handed down from one generation to another and are copied from one specification to another until engineers have come to regard them as an established form or custom. Like other beliefs instilled by constant repetition, these clauses are very difficult to displace or discredit.

For example, man has long preferred to kill the trees he used. Evidence of this preference can be found in thousands of specifications for poles, piles, posts and timbers in the familiar clause "shall be cut from live trees." The clause is not confined to old or carelessly drawn specifications. It is to be found in the latest specifications drawn by special committees of technical societies and by government and public utility engineers. Specifications for poles, piles or timbers which do not contain it are the exception rather than the rule.

Originally there was a good reason for the use of the clause. The influence of fire and disease on the strength of the wood in trees was unknown. Theory, it is true, indicated that unless death resulted from a wood-destroying fungus the manner in which a tree died had little or no effect upon the strength of the wood. The heartwood in all trees being dead, it appeared that the death of the cells in the cambium layer and sapwood would not affect cells which for years had not functioned in the life of the tree. There were, however, no strength figures to demonstrate that this theory was correct. Safety consideration, therefore, justified the exclusion of poles, piles and timbers cut from dead trees. In addition many users had experienced trouble from decay, checking and insect damage in material cut from dead trees. The clause "shall be cut from live trees" was, therefore, an indirect method of excluding much unsatisfactory material. Like many indirect methods the clause is inadequate, wasteful and difficult to enforce.

The clause is inadequate in that it does not exclude all unsatisfactory material. Poles, piles or timbers cut from live trees and left in the woods for any great length of time may be seriously damaged from decay, checking or insect attack. It is evidently necessary to limit directly these defects in material cut from live trees. If these defects can and must be limited directly in material cut from live trees they likewise can and should be limited directly in timber cut from dead trees. The important thing is the suitability of the pole, pile or timber for the use intended, and that depends on the defects present and not on how the tree died.

The clause is wasteful in that it does not discriminate between good and bad material. It rejects much excellent material suitable for use. Many a good chestnut pole killed by the blight has been left in the woods to rot on the stump because of this clause. The marketing of

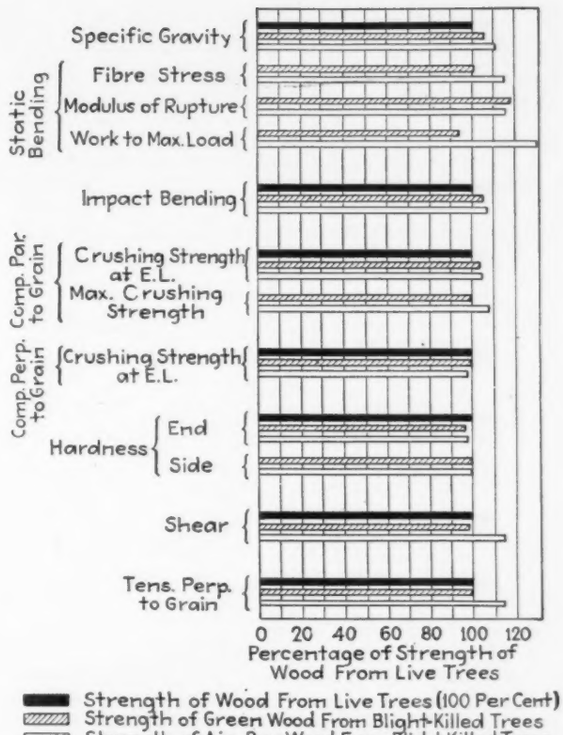


Fig. 1—Comparison of strength of chestnut from live and blight-killed trees

The tests numbered about 1,600 and included material from twenty chestnut trees. Five healthy and five blight-infected trees were selected from a site in Maryland and the same number from a site in New Jersey. The blight-infected trees from New Jersey ranged all the way from trees in which blight had killed only the top to trees which had been dead two years. The blight-infected trees from Maryland had all been dead from one to two years.

*Maintained at Madison, Wis., in co-operation with the University of Wisconsin.

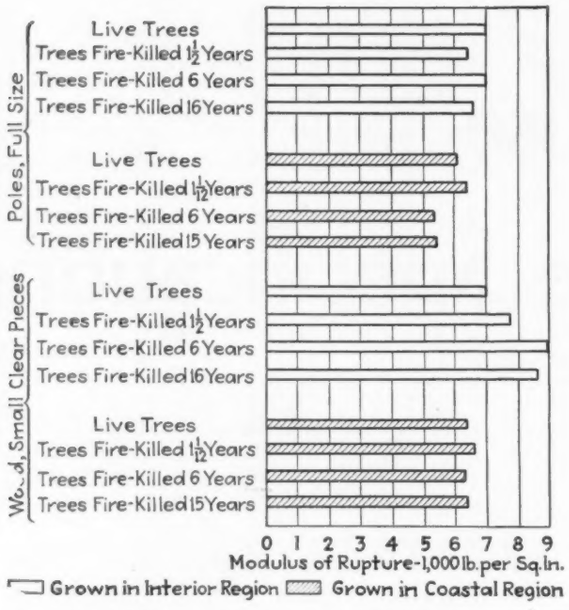

Poles, Full Size
Live Trees
Trees Fire-Killed 1½ Years
Trees Fire-Killed 6 Years
Trees Fire-Killed 16 Years
Live Trees
Trees Fire-Killed 1½ Years
Trees Fire-Killed 6 Years
Trees Fire-Killed 15 Years
Wood, Small Clear Pieces
Live Trees
Trees Fire-Killed 1½ Years
Trees Fire-Killed 6 Years
Trees Fire-Killed 16 Years
Live Trees
Trees Fire-Killed 1½ Years
Trees Fire-Killed 6 Years
Trees Fire-Killed 15 Years
0 1 2 3 4 5 6 7 8 9
Modulus of Rupture-1,000 lb. per Sq. In.
Grown in Interior Region
Grown in Coastal Region

Fig. 2—Comparison of modulus of rupture of poles and clear wood from live and fire-killed trees of Western red cedar

Compiled from Forest Service Circular No. 22 of Department of Interior, Canada.

blight-killed chestnut is an important economic problem that is being made more difficult by the clause. Likewise, the problems of utilizing fire-killed and wind-felled timber are made more difficult to solve. The solution of these problems is important to engineers as well as to foresters, for unsolved they mean the waste of enormous quantities of raw material.

The clause is difficult to enforce. Once a pole, pile or timber has been removed from the woods there is no positive means of determining whether it was cut from a dead or a live tree. Checks, decay and insect damage in poles or piles may indicate rather strongly that the pole or pile was cut from a dead tree, but they are not proof. Disputes as to how a tree died are likely to lead to lawsuits because of absence of facts on which to base settlement. A specification with a potential lawsuit in it is a poor specification.

Test data substantiate conclusions

Wood from blight-killed trees is as strong as that from trees killed by man with an ax, other things being equal. Tests (Fig. 1) made at the Forest Products Laboratory of the United States Department of Agriculture demonstrated this fact ten years ago. They justify the conclusion that sound wood from blight-killed trees is as strong as that from live trees.

The Canadian Forest Service and the United States Forest Service have both demonstrated by test that fire-killed timber which is sound is suitable for use as poles, posts, piles and timbers. The Canadian Forest Service made extensive tests on full-sized poles as well as on small clear pieces of Western red cedar which had been fire-killed. The results of these tests are published in Department of the Interior, Canada, Forest Service Circular No. 22, "Report on Tests of the Relative Strength of Green-Cut and Fire-Killed Western Red Cedar Pole Timber." A brief summary of the conclusions drawn from these tests is that the fire-killed pole as a unit has practically the same strength as the pole cut from a green tree, and that there is no difference in strength of wood in poles cut from live and fire-killed trees.

The modulus of rupture obtained on poles and on small clear pieces of wood in the tests on which this conclusion is based is shown in Fig. 2. Data on material from interior and coastal regions are shown separately.

Some of the results of United States Forest Service tests of fire-killed lodgepole pine poles have been published in United States Department of Agriculture Bulletin No. 67, "Tests of Rocky Mountain Woods for Telephone Poles." The modulus of rupture of lodgepole pine poles, two sets of which were fire-killed and four sets of which were cut from green trees, is shown in Fig. 3. The low strength shown for shipments 5 and 7 indicates that defects, taper and other factors had a much greater influence on the strength of poles than did the fact that the material was cut from live or fire-killed trees. The presence of either incipient or advanced decay will result in considerable deterioration in strength. Specifications should therefore provide for rejection of all poles containing decay in any form.

The United States Forest Service has also made tests of structural material cut from live and fire-killed trees. The results of these tests are published in United States Department of Agriculture Bulletin No. 108 "Tests of Structural Timbers." Fig. 4 is based on data taken from this bulletin and compares the modulus of rupture of material cut from green and fire-killed Douglas fir. Again the conclusion of the investigator was: "Tests on structural sizes do not indicate that the strength of fire-killed Douglas fir from the Pacific Northwest is less than that of green timber."

Considering all tests, the general conclusion can be

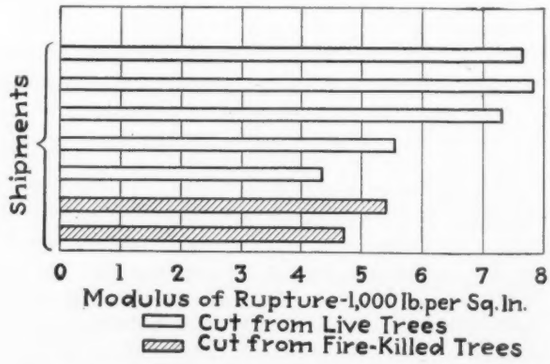


Fig. 3—Results of tests of poles cut from live and fire-killed lodgepole pine

Compiled from Forest Products Laboratory report "Results of Some Strength Tests on Wooden Poles." Shipments 5 and 7 contained a number of rough poles. The low strength of these two shipments indicates that defects and taper are more important than the condition of the trees from which the poles were cut.

The poles of shipment 5, which were the weakest of the poles from live trees, were rough, had large knots, and a large taper. Likewise, shipment 7, the weakest material from dead trees, contained some very rough poles. The results cannot therefore be given much weight in determining the effect of the death of trees on the strength of poles cut from them.

Shipment 6 stood on the stump ten years after being fire-killed. In many regions unfavorable conditions will result in considerable decay in lodgepole pine that has stood ten years on the stump.

drawn that sound wood from trees killed by fire, wind or bark diseases is as strong as the wood from green trees. Poles, piles or timbers cut from dead trees are equally as serviceable as those cut from live trees, provided they are sound, uninjured by insect attack, and have not checked excessively while seasoning on the stump.

It is evident that if we eliminate the old clause "shall be cut from live trees" we must replace it with limitations on decay, insect attack and checking. Limitations on these defects are desirable in any event for the rejection of damaged material cut from live trees.

The necessary protection can be provided by a few simple clauses. The application of these clauses requires the exercise of good judgment by inspectors. However, no specification for wood products, regardless of how carefully it is drawn, eliminates the necessity of good judgment by inspectors. The following limitations are suggested for the replacement of the old standby "shall be cut from live trees":

The —— shall be free from all forms of decay and from checks that are more injurious than the permissible shake. For round products, poles, piles, etc., the following additional clause is suggested: *Worm holes, blight, fire, or other scars or patches are permitted provided the wood is sound, the depth of scar does not exceed one-tenth of the diameter of the timber at the scar, and worm holes are not more injurious than the knots permitted.*

The foregoing clauses are intended to eliminate material that is unsatisfactory from a use standpoint. They are easier to apply and enforce than the old clause, and they permit the acceptance of suitable material regardless of how the tree it came from died.

The "sound" requirement should be strictly enforced. Inspectors should not assume that because wood has not crumbled under the fungous action that it is sound. Wood in the incipient stages of decay often remains firm, but is usually discolored* and the strength is injured. Such wood may be either from a live tree or from a dead tree, but it must be recognized that decay occurs more frequently in material from dead trees. Inspectors should therefore use exceptional care in inspecting material that is known to be or appears to be from dead trees and specifications may well contain instructions to inspectors to this effect.

Blue stain also discolors wood, but it does not injure the strength.

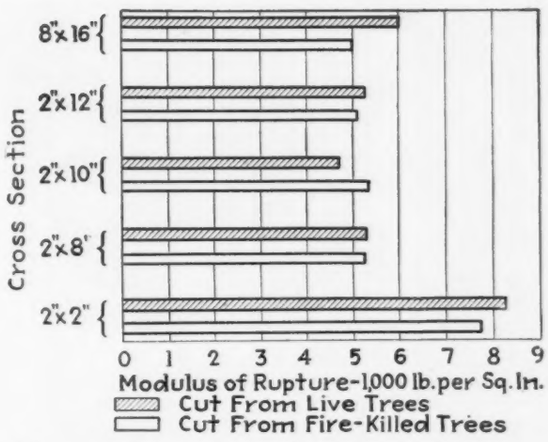


Fig. 4—Comparison of strength of timbers and wood cut from live and fire-killed Douglas fir

Compiled from United States Department of Agriculture Bulletin 108, "Tests of Structural Timbers."

Man can control the kill of the ax. So far, however, he has been unable to control the kill of the chestnut blight. He has succeeded only partially in controlling the kill by fire. He, of course, cannot control the kill by wind. If waste is to be prevented the kill from these and similar causes must be harvested as quickly as possible. The clause "shall be cut from live trees" is handicapping the harvest. There is no longer any excuse for continuing to use a clause which tests show to be based on an erroneous assumption and which is wasteful and difficult of execution when more direct and effective means are available. The engineering profession cannot afford to be responsible for the waste which will result from the continued use of the clause "shall be cut from live trees."

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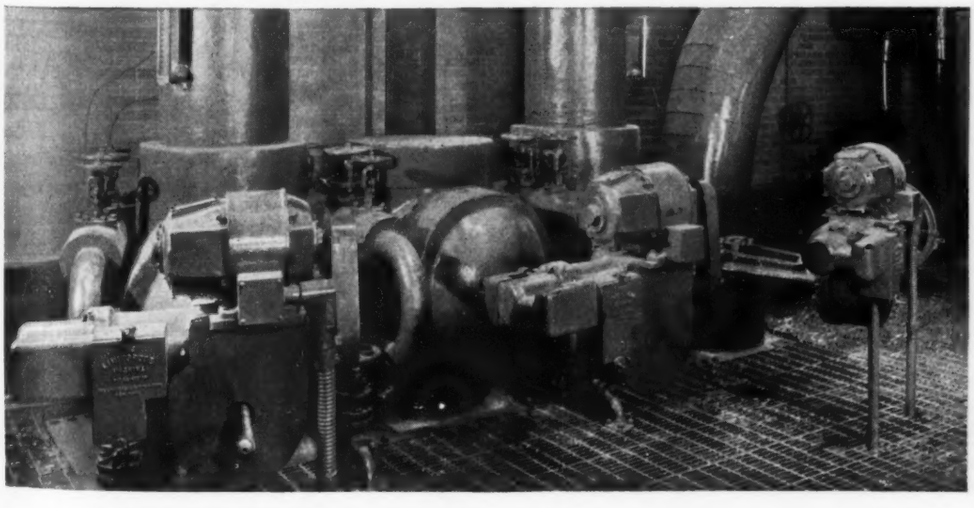
Motor-Operated Valves in Main Boiler Leads

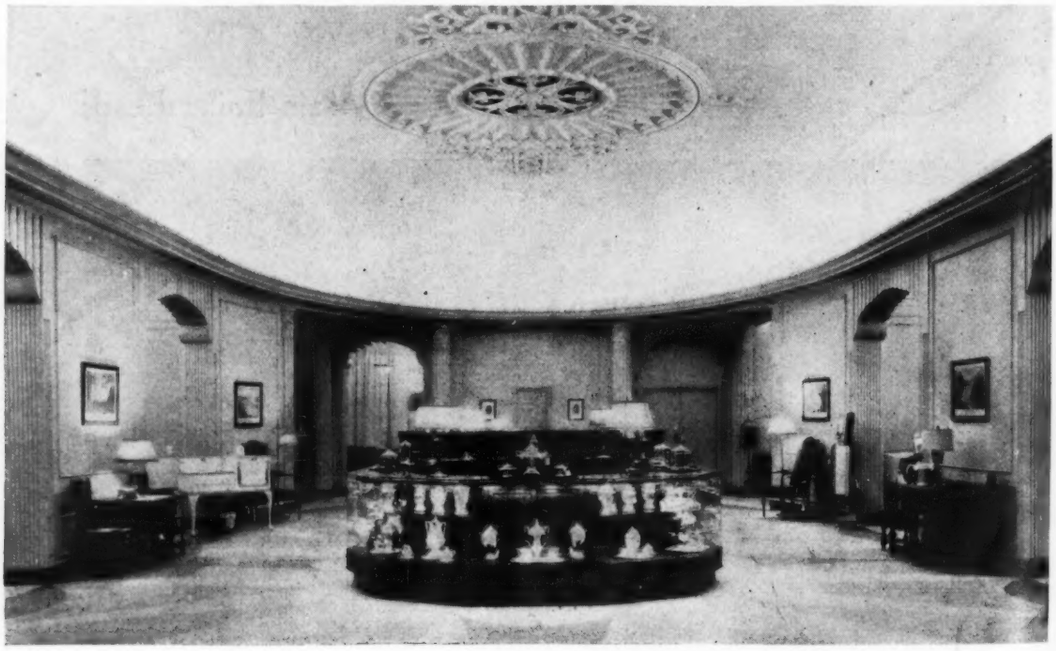


The principal valves in the J. H. Reed station, Pittsburgh, are electrically operated and remotely controlled. The most important are controlled from an isolated control board in the turbine room.

Niagara Falls Merchandises with Light

Modern lighting—praised, vilified, glorified and condemned—has sometimes deserved the varying degrees of criticism leveled against it, yet has risen above every detraction. The inherent values have made the idea triumph over the crudities of pioneering applications. At the new store and office building of the Niagara Electric Service Corporation, a unit of the Niagara Hudson System, at Niagara Falls, N. Y., a triumph of skill, cooperation, attractiveness and utility has been achieved that savors not at all of the experimental.

Here the changing-color, pilaster lighting controlled by dimmers and totaling 71,770 watts is a monument to what decorative architectural lighting can be and an invitation to come and buy. Ventilating ducts and accessibility for maintenance, with artistic effects at the pilasters, are the result of close architect-engineer co-operation. The main display room is a large oval space devoid of windows but lighted from a 16-ft. white ceiling by 16,800 watts of lamps concealed in the cornice. A splendid example of what good modernized lighting can do.



Equitable Life Discusses Its Investment Yardsticks

By W. C. GILMAN

Electrical Engineer, Treasurer's Office, Equitable Life Assurance Society of the U. S.

Funds of life insurance companies are assuming increasing importance as a source of capital for the utility industry. On December 31, 1930, the Association of Life Insurance Presidents estimated that the investments in the industry of 52 United States legal reserve life companies amounted to $1,686,000,000, of which more than 93 per cent was invested in mortgage bonds or debentures.

Since the total investment in the industry is estimated at the above date to amount to approximately $28,000,000,000 and since approximately one-half of this capital is provided through borrowed money, it is apparent that the life insurance companies have furnished, roughly, 11 per cent of the borrowed funds which have gone into the industry. On September 30, 1930, approximately 9.6 per cent of the total assets of these life companies were invested in public utility securities as compared to 4.7 per cent in 1906.

WITH a steady flow of funds available we are continually on the lookout for sound and profitable investments in the utility field. It is not our practice to wait for offerings of new issues, but rather to be ever scanning the field for deserving situations. This entails a continuous study of the many and rapid changes which have been and are now taking place among the utilities. We are thereby enabled to secure the utmost diversification in securities meeting our requirements in respect to quality and, not infrequently, to pick up securities of less-known companies before the general market has an appreciation of their true investment merits.

In the selection of public utility securities for investment the practice of the Equitable may be divided into three separate phases: (1) Preliminary examination; (2) field examination; (3) detailed study.

Preliminary examination is made

As a life insurance company domiciled in New York State, our investments are made in accordance with the laws of that state. Briefly, the law allows investment in:

Corporation bonds secured by adequate collateral security where at least two-thirds of the value of the required security consists of collateral other than stock.

Debentures, guaranteed stocks and preferred stocks of solvent American corporations where, during each of the five years next preceding investment, the corporation, or in the case of guaranteed stocks the guaranteeing corporation, shall have earned a sum applicable to dividends equal to at least 4 per cent upon all stock. In the case of stock having no par, the value upon which such stock was issued is taken. In the case of stocks, investment in such stock in any corporation is limited to an amount not in excess of 10 per cent of the total issued and outstanding preferred or guaranteed stock of the corporation, and to an amount not in excess of 2 per cent of the assets of the life insurance company.

Naturally, our first consideration is the legality of the securities of a company. If we find that the securities meet with the legal requirements we proceed with the preliminary examination, to consider the type of service supplied, the territory, the character of the management, the security and marketability of particular issues, earnings, etc., in a general way, from data which we have available in our office or through a questionnaire sent to the company. If after this study certain of the securities seem to meet our requirements, we place the company on our list for a field examination and a more detailed study. In special situations we sometimes waive the field examination.

The field examination entails a trip over the properties by the society's engineer who specializes in public utilities. The purpose of this trip is to obtain first-hand information regarding the situation which cannot be obtained by any office study. An inspection is made of the amount and condition of the physical property, the franchises, the rates, etc.

Observation is made of the character and ability of the management and of the territory served, public relations existing in the territory, the results obtained by the management in the operation of the property and the possibilities of future growth.

Upon the completion of the field examination a detailed study is made of the factors herein mentioned and others which we consider pertinent to the situation. Depending upon the conclusions reached, this report would or would not recommend the purchase of a particular amount of certain of the securities of the company under consideration. Factors to be considered follow:

Management and operations

(a) *Type of company*—In general, without consideration of the merits of any particular situation, we are most interested in straight electric companies; next, in combination electric and gas companies; next, in straight gas companies and in companies providing transportation service in combination with the above services. However, in view of the uncertain status of transportation, we limit ourselves to companies whose gross revenues from transportation do not exceed, say, 25 per cent of the total gross operating revenues, and where we consider there is an appreciable equity behind bonds and preferred stocks, entirely aside from the transportation investment. This discussion leaves out of consideration telephone securities, which, among most of the Bell System companies at least, occupy a peculiarly preferred position in the minds of investors, and telegraph companies, of which there are only two of importance.

As a general rule we are not interested in small companies with a large number of isolated plants and communities, but rather choose for investment companies serving a compact territory, interconnected in the case of electric companies. In any case gross operating revenues should amount to at least $2,000,000 per annum.

(b) *Management*—The question of management is one upon which, in all classes of investing, we lay great stress. Obviously, we can lay down no mathematical formula, nor anything approaching fixed standards by which to determine whether or not a management qualifies. But, in general, the management should have a well-established record for successful operation; its properties should show steady, normal growth in earning power; its accounting practices must be conservative; its securities should have given a good account of themselves in the market, and its bankers should be above reproach. It is all summed up in the single word "credit." We like to receive regular monthly earnings statements and balance sheets of companies whose securities we hold and we lean toward managements which send out this information in intelligible and understandable form.

An important indication of the soundness of a utility's future may be found in its relations with the public it serves. Investment in situations where there are continuous troubles and litigations with the public authorities and the public in general should be avoided. Closely allied with the question of public relations is the very important subject of rates for the service furnished. This question resolves itself into a study of the rates for domestic and small light and power sales for electric companies and domestic sales for gas companies, since the rates for sales to large users are in competition with other forms of energy. No particular brief is held out for any special form of rate, but it is felt that the managements of companies which have not yet installed some form of promotional schedule, with a reasonably low step for full use of the commodity, are not fully alive to their opportunities. The sale of preferred stock in the territory served is also of considerable importance from a public relations standpoint, and as a general rule the institutional investor looks with favor on companies where this practice has been followed.

(c) *Security of Issue*—We do not look with favor upon the practice of "writing up" property to the basis of the present reproduction cost, believing that a much truer picture is obtained if the property account is carried at original cost. A fixed property account of $10 per dollar of gross operating revenue would be considered unusual, and unless accompanied by an operating ratio in the neighborhood of 35 per cent would require some specific explanation. In any event, in determining the security behind any particular issue, we attempt from old records available and from a list of the present physical property to estimate this original cost. In general, in the case of bonds and debentures we are interested only in the companies the value of whose property on a reasonable original cost basis is at least 1½ times the amount of bonds and debentures outstanding. In taking this position, I am expressing no thought upon the basis of valuation to be used in rate making. Historical cost may or may not be a factor here, but I do feel that the property account, as given in the balance sheet, should present a record of what money has actually been put into the property.

In the case of preferred stocks we like to assure ourselves that such stocks are really represented by property the value of which, on the above basis, is at least twice the amount of preferred stock outstanding. It might be mentioned that in case of companies with an appreciable amount of street transportation property we believe the above ratios should be met after deducting the value of the transportation property. We approve of the open-end type of mortgage with proper earnings and property restrictions as to drawing down further bonds, but we do object to the increasing tendency to liberalize mortgage restrictions. As an example of such flexibility we quote the following from the terms of the mortgage, now happily changed, of a well-known utility authorizing the holders of 80 per cent of the principal amount of the bonds outstanding under said mortgage at any time to:

> "Change the maturity, interest rate, or any other provisions of bonds or coupons then outstanding or thereafter," or to "require or permit bonds outstanding hereunder to be converted into other bonds or shares or other securities, whether of the company or of any other corporation formed or to be formed."

We have considerable doubt as to whether bonds which are subject to modification in such important respects as these are legal investments for life insurance companies. In any event, we do not think that such a company can with propriety invest its policyholders' funds in a security which carries no definite obligation on the mortgagor's part to pay interest at a fixed rate and to pay the principal amount at a day certain, and which subjects the holder to the hazard of being compelled to accept, in place of the security which it bargained for, shares of stock in "any other corporation." To be quite blunt, some lawyers engaged in drafting utility mortgage indentures have

reached a degree of smartness which, if continued, can have only an unfortunate effect upon the attitude of institutional investors.

(d) *Earnings*—We have no fixed standard as regards operating ratio, since this figure varies so considerably with companies of different types, but we naturally like to see, over a term of years, a downward trend in this ratio. Gross operating revenues and net earnings of the company or its predecessors should show a healthy expansion over a period of at least ten years. In so far as earnings ratios are concerned in the case of bonds and debentures, we like the securities of companies whose net earnings *after adequate depreciation* and *all* taxes are at least $2\frac{1}{4}$ times bond and debenture interest. In the case of preferred stocks, the company should earn, *after adequate depreciation* and *all* taxes, its total fixed charges and preferred dividend requirements at least twice. Interest during construction should be separately stated, and in our opinion should be treated as "other income." With very large companies enjoying strong inherent stability of earning power, we may relax our statistical requirements somewhat. For utilities with an appreciable amount of revenue from street transportation sources we would in certain cases want the company to meet the above ratios without including the earnings of the transportation department.

In calculating these ratios we use the "over-all" basis, and this in itself limits our buying into but very few holding company situations.

We like to assure ourselves that companies whose securities we hold are expending for current maintenance sufficient amounts to keep the property in the best operating condition and that no proper maintenance expense is going into the fixed capital account. While criticism can be made of considering maintenance as a percentage of gross operating revenues, nevertheless it is our belief that maintenance is more nearly a function of revenue than of any other single item, and tempered with the facts concerning the company's operations (i.e. electric, steam or hydro; street railway, etc.) a fairly good indication of the state of the company's property may be obtained from a study of this ratio. We consider the following percentages as standard, and in case of companies with ratios below this standard we look for a satisfactory explanation:

	Maintenance Expense as Percentage of Gross Operating Revenue
Electric companies	6
Gas companies	7
Combination companies having 25 per cent of gross from street transportation	10

In a similar manner we study appropriations from earnings from renewals and retirements, and again we feel that a study of this charge to earnings is best made through considering it as a definite percentage of gross operating revenue. In general, we feel that appropriations for renewals and replacements should run about as follows:

	Accrual from Earnings for Renewals and Replacements as a Percentage of Gross Operating Revenue
Electric companies	7
Gas companies	7
Combination companies having 25 per cent of gross from street transportation	10

Naturally we do not have any set rule which would throw out of consideration the securities of a company whose maintenance and/or depreciation failed to come up to the above-mentioned standard, but in such a case we would want to be thoroughly convinced that in view of some special situation affecting the company the charges as made were adequate. Incidentally, it might be mentioned here that the application of any ratios of operation involving the use of gross operating revenues has in recent years become more complicated due to the practice of certain companies of including, in gross operating revenues, gross income received from merchandising and jobbing operations. While there may be some question as to the proper accounting procedure for this business, it is our thought that a better picture of a utility company is given by including net profit (or loss) from such merchandising or jobbing operations in the income account as "other income." With gross merchandise revenues amounting with some companies to 10-15 per cent of gross revenue from strictly utility operations, it is obvious that the operating, maintenance, and renewals and replacement ratios are considerably affected by any change in the method of accounting for this business.

(e) *Territory*—We like to invest in companies serving a territory which is growing in population and importance, and where revenues are derived from a well-diversified type of customers. We demand an exceptionally strong record with utilities serving only "one-industry" towns or, in the case of electric companies, territories where more than 50 per cent of the gross electric revenue is derived from sales to large power customers. For investment purposes we favor states where there is a strong public utility commission, and where the commission actually has some power to exercise supervision over the operations of the utility companies within the state.

Franchise question important

Other things being equal, we prefer to invest in utilities in states where the indeterminate permit law is in effect, since such a law in most cases effectively removes from the field of local politics the question of franchises. In any event, before investment, we wish to satisfy ourselves that the company's franchise situation is satisfactory. As a general rule we try to avoid states where the question of public versus private ownership is in the political arena. There are very few places where any competition exists between utilities offering the same type of service, and in these locations agreements should exist between the competitors as to a division of the territory and business.

When it is all summed up our interests and that of the management are or should be the same, namely, the successful, conservative operations of the property; this including, of course, good service at reasonable rates. In conclusion, it might be stated that when a particular security has been thoroughly investigated, found suitable, and purchased, the job is only half done. From that time on it must be carefully watched, and changes and developments which may affect the security of the issue and the earnings behind it must be noted and weighed. We usually buy securities in sizable blocks, and consequently must be in such close touch with situations that we are able to take prompt and appropriate action with regard to any changes in a particular situation before any inkling of such change is generally known in the market.

Energy Generated in Central Station, Railway and Other Utility Plants

Figures for 1920, 1928 and 1929 are taken from reports of the U. S. Geological Survey; 1930 figures are based on ten months' operation.

	Electrical Energy Generated (Thousands of Kilowatt-Hours)			
	1920	1928	1929	1930
UNITED STATES	43,554,880	87,849,579	97,352,385	96,021,000
New England	3,406,712	5,958,843	6,608,790	6,358,000
Middle Atlantic	12,348,510	22,657,059	24,784,453	25,159,000
East North Central	9,958,373	20,946,994	23,333,008	22,261,000
West North Central	3,179,426	5,125,705	5,675,445	5,979,000
South Atlantic	3,994,308	10,499,780	11,901,577	10,959,000
East South Central	1,449,054	3,326,276	3,623,146	3,724,000
West South Central	1,229,604	4,035,380	4,896,023	5,060,000
Mountain	2,580,979	3,917,948	3,966,610	3,771,000
Pacific	5,407,913	11,381,594	12,563,333	12,750,000
NEW ENGLAND				
Maine	352,426	693,919	719,710	713,000
New Hampshire	96,602	301,514	310,138	345,000
Vermont	199,608	452,245	463,797	469,000
Massachusetts	1,739,946	2,751,468	3,026,426	2,900,000
Rhode Island	333,698	489,525	652,743	567,000
Connecticut	684,432	1,270,172	1,435,976	1,364,000
MIDDLE ATLANTIC				
New York	6,939,042	13,030,301	14,465,073	14,435,000
New Jersey	1,095,927	2,085,258	2,164,728	2,834,000
Pennsylvania	4,313,541	7,541,500	8,154,652	7,890,000
EAST NORTH CENTRAL				
Ohio	2,929,788	5,538,758	6,416,941	5,958,000
Indiana	932,727	1,989,495	2,575,930	2,965,000
Illinois	3,042,691	6,965,681	7,369,263	6,891,000
Michigan	2,092,864	4,346,637	4,695,266	4,284,000
Wisconsin	960,303	2,106,423	2,275,608	2,163,000
WEST NORTH CENTRAL				
Minnesota	703,315	1,065,262	1,202,307	1,306,000
Iowa	1,016,766	1,520,639	1,499,476	1,577,000
Missouri	698,225	990,792	1,220,661	1,272,000
North Dakota	28,259	85,385	104,979	125,000
South Dakota	48,014	105,887	107,738	115,000
Nebraska	247,195	464,291	533,235	571,000
Kansas	437,652	893,449	1,007,049	1,013,000

	Electrical Energy Generated (Thousands of Kilowatt-Hours)			
	1920	1928	1929	1930
SOUTH ATLANTIC				
Delaware	75,575	100,074	52,867	18,000
Maryland	282,724	1,477,025	2,010,799	1,872,000
Dist. of Columbia	254,949	467,206	505,122	549,000
Virginia	520,854	1,168,500	2,197,162	1,237,000
West Virginia	1,128,381	2,044,790	2,219,880	2,142,000
North Carolina	259,708	2,225,332	2,552,376	2,382,000
South Carolina	729,998	1,399,205	1,457,499	1,161,000
Georgia	609,488	981,072	1,135,539	906,000
Florida	132,631	636,576	670,333	692,000
EAST SOUTH CENTRAL				
Kentucky	275,760	625,149	715,351	716,000
Tennessee	572,615	956,094	1,020,957	823,000
Alabama	535,065	1,694,673	1,829,952	2,123,000
Mississippi	65,614	50,355	56,886	62,000
WEST SOUTH CENTRAL				
Arkansas	118,710	149,583	127,839	106,000
Louisiana	218,529	821,102	989,736	1,059,000
Oklahoma	213,828	843,794	977,132	977,000
Texas	678,537	2,220,901	2,801,316	2,918,000
MOUNTAIN				
Montana	1,126,016	1,619,351	1,613,668	1,343,000
Idaho	590,864	947,709	894,417	921,000
Wyoming	46,754	83,931	98,665	104,000
Colorado	397,286	541,150	563,813	576,000
New Mexico	14,961	52,326	67,179	75,000
Arizona	159,228	335,755	283,023	401,000
Utah	212,321	282,791	402,005	306,000
Nevada	33,549	54,935	43,840	45,000
PACIFIC				
Washington	1,196,725	2,361,024	2,552,325	2,563,000
Oregon	475,543	1,040,743	1,161,386	1,217,000
California	3,735,645	7,979,827	8,849,622	8,970,000

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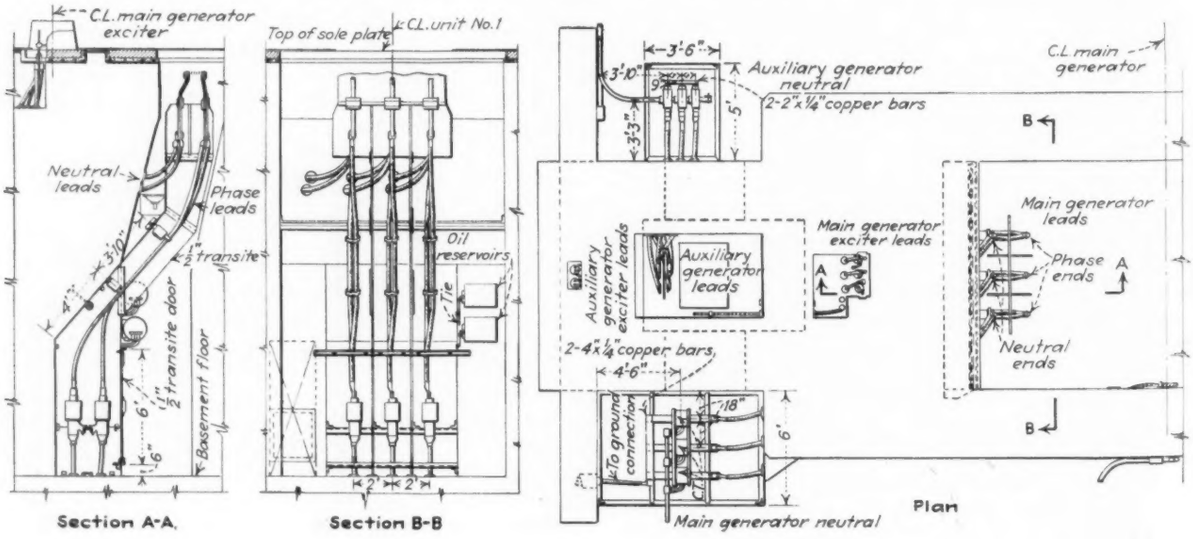
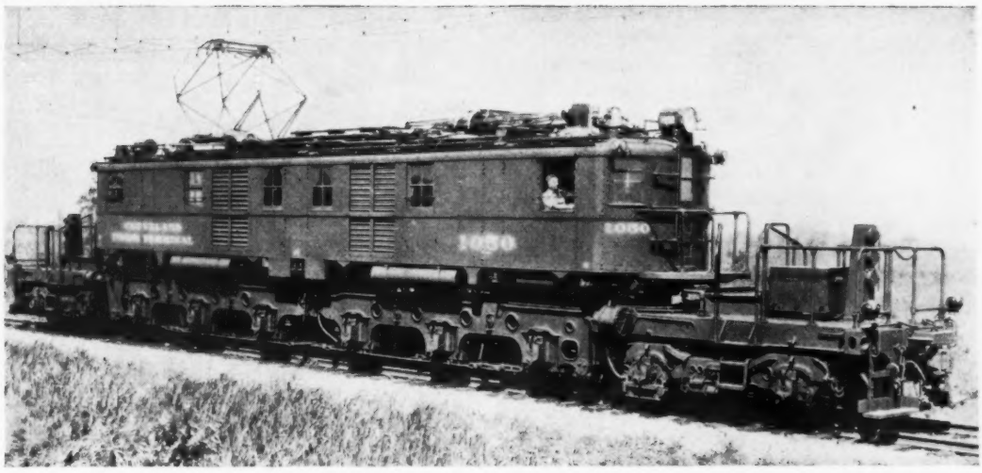
Neat Disposition of Generator Leads

The arrangement of generator leads in the foundations of the first two units at the Powerton station of the Super-Power Company of Illinois presents a neat disposition of many cables. On the single shaft of each of these units are main and auxiliary generators and their respective exciters. The main leads, 22,000 volts, are taken away in oil-filled cables, two to a phase. The auxiliary leads, 2,300 volts, run into ordinary varnished-cambric cables. The auxiliary neutral is not grounded.





3,000-volt direct-current locomotive for terminal service

Railroad Electrification Brings Economies*

By H. L. ANDREWS

Transportation Engineering Department, General Electric Company

THE steam locomotive is so generally used and is so successful in meeting the demands of an exacting transportation system that there should be some good reason for considering other types of motive power. However, in each field of railroad trunk line transportation modern electrical equipment makes an important contribution, either in reduction of smoke or noise, reduction in running time—thereby permitting faster and more comfortable means of transportation for the public—or by effecting a reduction in fuel, labor and maintenance, thus making it possible to handle a ton-mile at a lower cost.

The most recent suburban operations to adopt modern electrical equipment are the Pennsylvania and Reading at Philadelphia and the Delaware, Lackawanna & Western at Hoboken.

The Pennsylvania and Reading, using the 11,000-volt, 25-cycle, alternating-current system, are outstanding, not particularly for the magnitude of the suburban undertaking, but for the fact that the initial suburban electrification is an integral part of an extensive project in main line electrification.

While weight reduction in this class of service is not as important as in other forms of transportation, it is of interest to point out the progress made in the single-phase commutator motor in this respect. A reduction in weight from 50 lb. to 25 lb. per continuous horsepower output, a saving of 50 per cent has been secured. While this in itself is an outstanding contribution, it is of particular interest to note that coincident with this weight reduction the number of poles used with the single-phase motor has been doubled, roller bearings have been introduced, the commutating capacity has been increased to permit a 25 per cent increase in the rates of acceleration and the brush life increased from 12,000 miles to 60,000 miles, or nearly five times the life secured with the older type motors.

Remarkable advances have been made in the protective equipment for these 11,000-volt distribution circuits, the most notable achievement being the high-speed air circuit breaker (installed out of doors). This breaker will interrupt a short-circuit current value of 50,000 amp. in 0.04 second, or within a single cycle of a 25-cycle wave.

The Delaware, Lackawanna & Western suburban electrification is outstanding in two respects: First, it is the initial suburban project in this country to utilize the 3,000-volt direct-current system for multiple-unit cars, as well as the first project of its magnitude in the world to use this system in suburban service, and, second, it is the first steam railroad operation of any magnitude in the world to rely entirely on 3,000-volt mercury-arc rectifiers as conversion units. (ELECTRICAL WORLD, page 704. April 5, 1930.)

The most noteworthy contribution to the multiple-

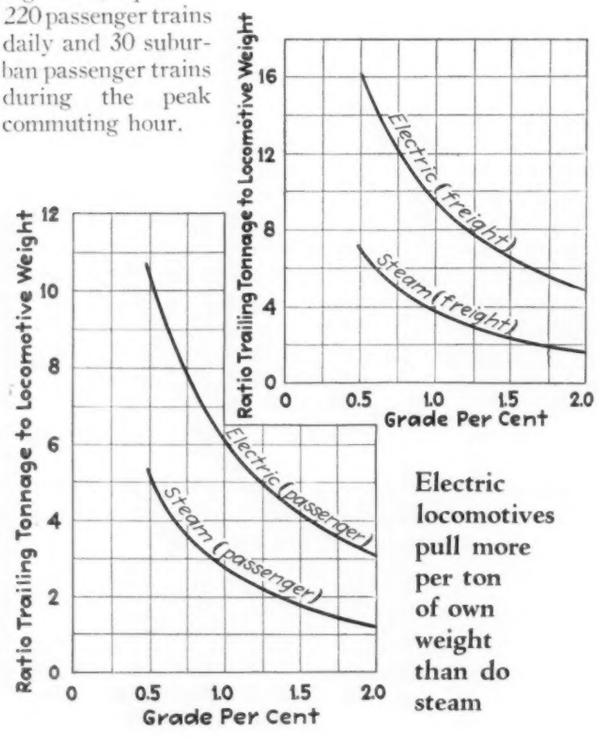
**Excerpts from "The Contribution of Modern Electrical Equipment to Transportation" as presented by Mr. Andrews at a recent meeting of the New York Railroad Club.*

unit cars of this project is the traction motor, which has a weight of 35½ lb. per continuous horsepower, the lightest weight self-ventilated suburban traction motor in the world. There are no motors of similar design in this country with which a comparison can be made to indicate the progress in this respect.

A distinct contribution, both from the standpoint of efficiency and floor space occupied, is the mercury-arc rectifier equipment, 40,000 kw. of which is in operation on this project. Attention is particularly directed to the high efficiency of the rectifier itself—98.7 per cent at full load—and the high over-all efficiency of the substation, including the transformers and rectifiers—97 per cent at full load—a gain of 10 per cent in efficiency over a motor-generator set station of similar capacity. This in itself, of course, makes a material reduction in the amount of power used and contributes to the high over-all efficiency of this system from three-phase a.c. power to the wheel of the transportation unit.

Aside from the increased efficiency, which is of primary importance, the mercury-arc rectifier further contributes by reducing weight and floor space per kilowatt output. These indicate a reduction in weight of equipment of 45 per cent; in floor space of 50 per cent; in cubical contents of building of 75 per cent and in cost of building of 57 per cent. These advantages are in themselves major contributions to the transportation industry.

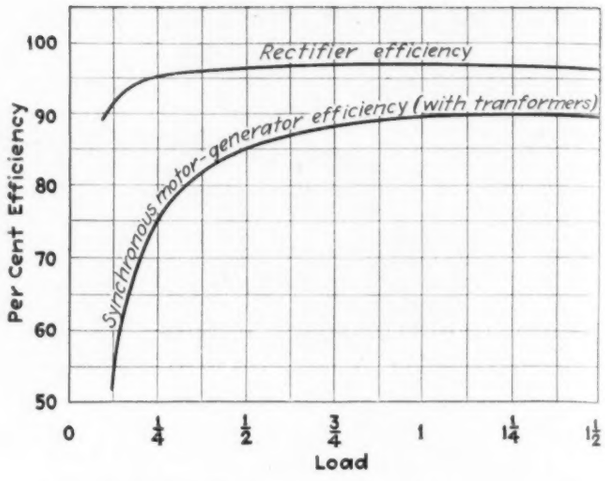
The suburban service of the Lackawanna under steam operation handled 20,000,000 commuter passengers during 1929, operated 220 passenger trains daily and 30 suburban passenger trains during the peak commuting hour.



Electric locomotives pull more per ton of own weight than do steam

Under electrical operation 141 cars equipped with motors having a total capacity of 133,000 hp. replaced 120 steam locomotives with an aggregate capacity of 180,000 hp.

Distribution of the motors throughout the train, rather than the concentration of all tractive effort in the drivers of the steam locomotive, makes it possible to increase the rates of acceleration with a resultant reduction of 25 per cent in running time.



Comparative efficiencies of 3,000-kw. mercury rectifiers and motor-generator sets of same rating

The reduction in terminal time and the higher schedule speeds secured under electrical operation permit increasing the frequency of service. The total number of suburban trains operated per day under complete electrical operation will be 167, or an increase of 12 per cent over the corresponding steam service.

The most recent terminal where modern electrical equipment has contributed to handling main line trains is the 17-mile electrification of the Cleveland Union Terminal Company. This installation uses the 3,000-volt direct-current system and is the first project of its kind in the East to use a high-voltage direct-current system under heavy passenger traffic conditions. There are 22 3,000-hp. locomotives operating in this zone, or 1.3 locomotives per mile of route—all handled from two substations with a total installed capacity of 15,000 kw.

Use of high-speed air circuit breakers as protection to and for sectionalizing the distribution systems is an important accomplishment. These circuit breakers will interrupt a short-circuit current of 40,000 amp. in 0.008 second.

Because of its unlimited source of power the straight electric switching locomotive using central-station power is more powerful and effective than internal-combustion-electric units or battery combinations. Its tractive power is limited, as in all cases, by the weight on drivers, but the speed at which this tractive power is obtained is only a question of motor capacity.

By reason of the fact that there are practically no reciprocating parts in a locomotive of this type, it reduces maintenance costs, compared with a steam locomotive, 75 per cent. For the same reason the percentage of time it is available for service is higher, and this reduces the number of units in service 50 per cent. As it receives its power supply from a continuous overhead conductor it can be constructed with all weight on drivers—i.e., useful weight—and thus reduces the total weight per pound of starting tractive effort 50 per cent. Likewise, it uses power only when it is required for movement, has prac-

Trunk Line Electrification Saves Operating Expenses

Expressed in percentages of steam operation costs for identical items

Company	1	2	3	4	5	Average
Locomotive repairs	31	91	64	70	83	70
Engine house	42	50	60	61	80	66
Lubricants	53	97	19	10	79	60
Water	77	0	100	100	..	..
Supplies	28	..	69	47	65	62
Enginemen	37	53	42	58	72	51
Trainmen	27	50	33	55	..	41
Total	36	62	41	54	78	52

Return on Investment in Trunk Line Electrification

For five trunk lines shown in accompanying table of operating expense savings

Year	Route-Miles Electrified	Capital Employed in Fixed Installations	Savings Realized	Savings in Per Cent of Capital Employed
1922	27	$1,215,400	$390,200	32.1
1923	27	1,215,400	347,200	28.6
1924	27	1,215,400	252,700	20.8
1925	27	1,401,400	347,400	24.8
1926	58	2,238,100	423,800	18.2
1927	83	3,430,900	608,600	17.7
1928	177	3,784,700	794,500	21.0
1929	177	7,633,800	1,446,000	18.9

Mercury-Arc Rectifiers Show Substation Savings

	600 Volt	3,000 Volt
Reduction in weight of equipment (per cent)	15.0	45.0
Reduction in floor space (per cent)	None	50.0
Reduction in cubical content of building (per cent)	60.0	75.0
Reduction in cost of building (per cent)	20.0	57.0

Contribution of Electric Locomotives

To Trunk Line Transportation

Eliminates coal, water, ash-handling facilities, wyes and turntables

	Per Cent
Reduces number of units in service	50
Reduces total weight per horsepower output	47
Reduces maintenance	75
Reduces non-useful weight	70

To Switching Service

	Per Cent
Reduces maintenance expense	75
Reduces number of units in service	50
Reduces weight per pound of starting tractive effort	50
Reduces fuel expense	40–60
Reduces time to handle a ton-mile	30
Reduces operating costs per hour	25–50

tically no stand-by losses and thus reduces the fuel expense from 40 to 60 per cent, depending on the relative price of coal and electrical energy. Because it is more easily handled, has unlimited power supply, is usually constructed with all weight on drivers and can be more easily reversed in direction of movement, it reduces the time to handle a ton-mile 30 per cent. Finally, as a result of these gains, it reduces operating costs per hour of the motive power unit 25 to 50 per cent, depending on the number of hours per day operated.

In main line long-haul freight and passenger service the most recent operations to adopt modern electrical equipment to meet the demands of this phase of transportation are the Pennsylvania and New York Central Railroads.

The Pennsylvania Railroad, using the 11,000-volt, 25-cycle a-c. system, has adopted two types of high-speed passenger locomotives and one type of freight locomotive. These are of unusual interest in that the horsepower capacity installed per axle is higher than any other installation in this country. Each axle of this company's passenger locomotives is equipped with twin motors having a combined continuous rating of 1,250 hp. The freight locomotives can handle from sixteen to five times their weight, whereas the steam locomotives can haul only seven to two times their weight.

This performance on the part of the electric locomotive permits a reduction in operating costs and consequently the handling of a ton-mile at a lower cost. Data are shown on five trunk line electrifications giving reductions in operating costs. The average of all savings is equivalent to 52 per cent of the cost under steam operation.

Even with these substantial reductions one naturally asks the question whether they are sufficient to pay a fair return on the capital invested. In these particular illustrations the answer is without question "yes," as they are installations which have been in operation for an appreciable period and the results are well known.

The value of the savings realized is shown, as well as these savings expressed in per cent of the capital employed. These have varied through a period of eight years from a return of 19 to 32 per cent of the capital invested, which can be considered a reasonable return.

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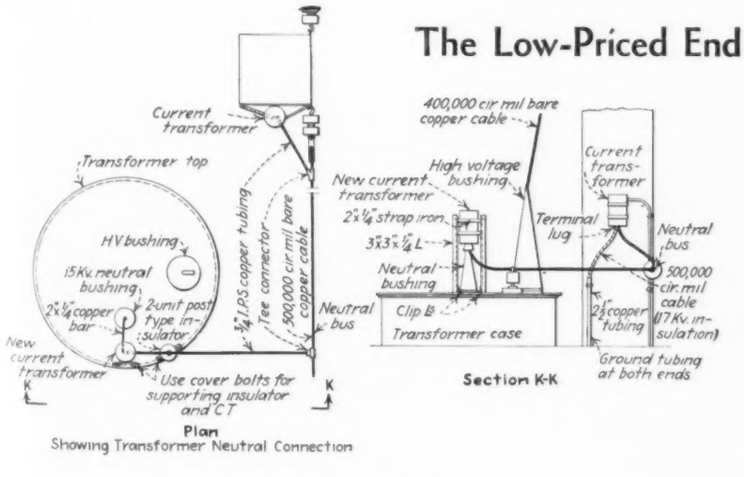
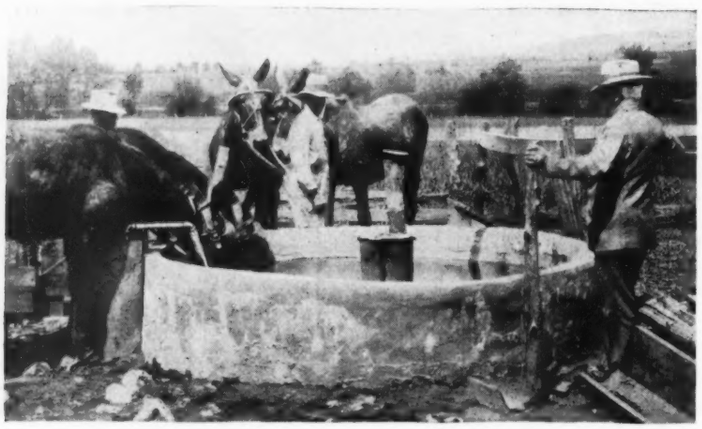
The Low-Priced End



After the 132/22-kv. transformers at Powerton were installed it became apparent that the secondary burden on the bushing-type current transformers would be excessive on account of additional protective equipment installed. Since 132-kv. current transformers are relatively expensive, the Super-Power Company of Illinois decided to provide the additional secondary capacity needed by installing 15-kv. current transformers in the neutral and low-tension phase legs. As the usual position for neutral current transformers was already occupied by metering units, the supplementary current transformers were mounted on the 132-kv. transformer cases adjacent to the neutral bushing and connected by copper tubing to the neutral bus as shown.

100 Alabama Farms Averaged 10,278 Kw.-Hr. Annual Use

By E. C. EASTER
Chief Agricultural Engineer Alabama Power Company Birmingham, Ala.



Electricity supplies water for livestock

This watering trough on the farm of Clarendon Davis, Huntsville, is filled by an electrically driven pump.

FOR a number of years it has been known that farmers want the convenience of electric service, and that the power companies generally are interested in providing the service. But the major question involved has been and continues to be, Can and will the farmer use electricity in sufficient volume to make electric service satisfactory to him and to the power company? Experimental studies throughout the country indicate that there are many uses that the farmer can make of electricity, and the kilowatt-hour consumption records of farm customers are conclusive indications that farmers will and are using electricity in steadily increasing quantities.

In the early part of this year the national committee included in its questionnaire a request that each company furnish a list of twenty farms using the greatest amount of electricity. In preparing this list from customer records of the Alabama Power Company it was observed that many of the farms were using large volumes of electricity and 100 farms were selected from the list that were using electrical energy at the rate of 1,027,838 kw.-hr. per year, or an average of 10,278 kw.-hr. per farm.

Of the 100 farms, the types of farms and the amounts of electricity used by each type were as follows:

Type Farm	Number	Total Annual Consumption, Kw.-Hr.	Average Annual Consumption, per Farm, Kw.-Hr.	Average Connected Load per Farm, Kw.-Hr.
Dairies	51	726,252	14,240	5.45
General farms	41	262,985	6,414	4.6
Poultry	3	12,328	4,109	3.3
Truck	3	15,864	5,288	7.7
Pecan	1	5,050	5,050	3.5
Nursery	1	5,359	5,359	3.0
Total	100	1,027,838	10,278	5.06

Of the electricity used by the 100 farmers, approximately 65 per cent was used for farm operations, including dairy refrigeration, milking machines, grinding, pumping water for the home, pumping water for irrigation, incubation, brooding and other miscellaneous jobs on the different farms. Approximately 350,000 kw.-hr. of electricity was used at the 100 farm homes for lighting, cooking, pumping water, refrigeration and the use of small household labor-saving appliances. The 100 farms are scattered over each of the six agricultural sections of the state in 25 different counties and are using electricity only as any successful farm of the same types can use it satisfactorily. In fact, these farms are continuing to increase their uses of electricity through the installation of additional equipment. They are enjoying the comforts and conveniences of electric service in their homes and, in addition, electricity is reducing farm-operating costs sufficiently to more than "pay its way" on the farm.

In 1924 the Alabama Power Company's rural customers were using electricity at the average annual rate of 383 kw.-hr. per customer. Since that time the company has added new rural customers at the rate of 126 per month, and even with the continuous addition of the new customers, there has been a continuous increase in the average rate of energy consumption, as shown in the following table:

Year	Average Annual Consumption per Rural Customer, Kw.-Hr.	Number of Rural Customers per Mile of Line	Annual Consumption per Mile of Rural Line, Kw.-Hr.
1924	383	9.85	5,345
1925	437	9.79	5,830
1926	446	8.34	6,880
1927	708	7.90	7,308
1928	834	6.60	7,481
1929	840	5.14	8,160

The average annual kilowatt-hours per rural customer does not include any rural community enterprises, as gins, grist mills, etc., but annual kilowatt-hours per mile of rural line includes all of the energy that is used from rural lines.

Even with the constant addition of lines with a gradually decreasing density of customers per mile, there has been an increase each year in the kilowatt-hour consumption per mile of line. This has been possible through the company's efforts to familiarize rural customers with the ways that electricity can be used by individual customers and to operate rural community enterprises.

The company has also observed that as the number of customers per mile of line decreases the amount of elec-

Relation of Consumption per Customer to Density of Customers

Based on Lines Less than Three Years Old

Rural Customers per Mile of Line	Number of Customers	Annual Kw.-Hr. per Rural Customer
5 or less	169	2,841
5 to 10	988	663
10 to 15	962	504
15 to 20	291	481

Possible Power Requirements in the Farm Home

	Average Power Required per Year	
	Kw.-Hr.	Horsepower-Hours
Lighting and small appliances, as irons, churns, etc.	300	400
Water pump	200	267
Refrigerator	900	1,200
Cooking	1,500	2,000
Total	2,900	3,867

tricity used per customer increases, due to the fact that there is generally more wealth per customer and more operations to which electricity is applicable on the larger farm than on the smaller ones.

According to Bulletin 1348 of the U. S. Department of Agriculture, the farms in Alabama use an average of 730 hp.-hours per year per farm, or a total of 186,000,000 hp.-hours used annually on all of the farms of the state. And if we assume that only that part of this power to which electricity is adapted represents the available electric load, we have a very incomplete picture of the possibilities of farm and rural electrification.

As a matter of fact, there is considerably more power required in the average farm home, to which electricity is practically and well adapted, than the total power used on the average farm for farm operations.

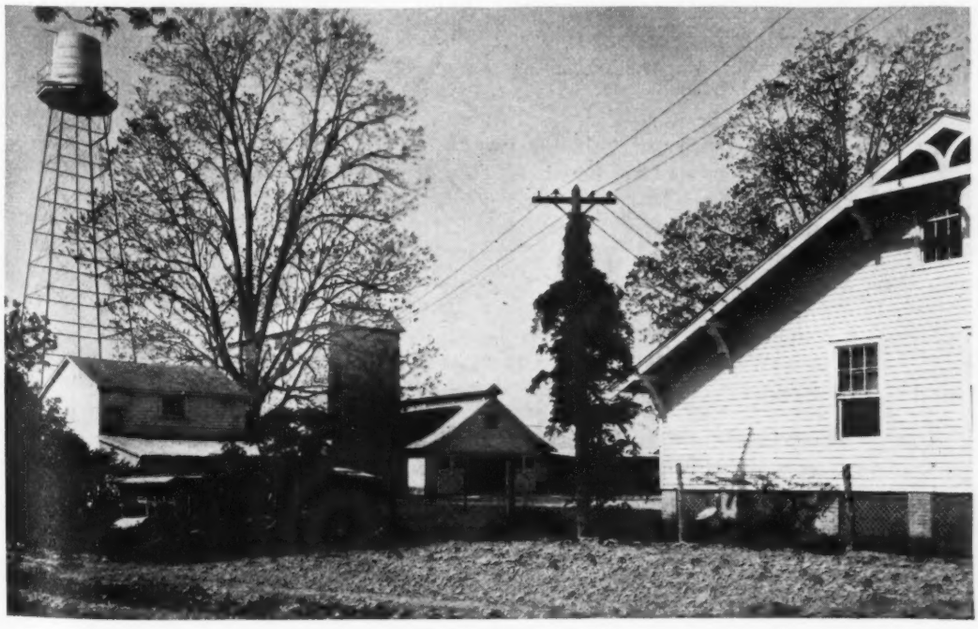
We have experienced that each of the foregoing four operations, which are essentially necessary in every farm home, are such that the use of electricity is well adapted and entirely satisfactory with equipment at present available. In addition to the uses of electricity in the farm home, there is, on practically every farm, some practical and economical way of utilizing electric light, heat or power to reduce operating costs or increase the farm income.

Electric lights protect fruit from insects

Damage by the tomato fruit worm was prevented by the use of light traps on the farm of W. F. Boyles, Mobile.

In Alabama electric energy is assisting poultry farmers in supplying light, pumping water, grinding feed, and heating incubators and brooders, and it has proved valuable to the general farmer in providing refrigeration for preserving meats, fruits, vegetables and milk products.

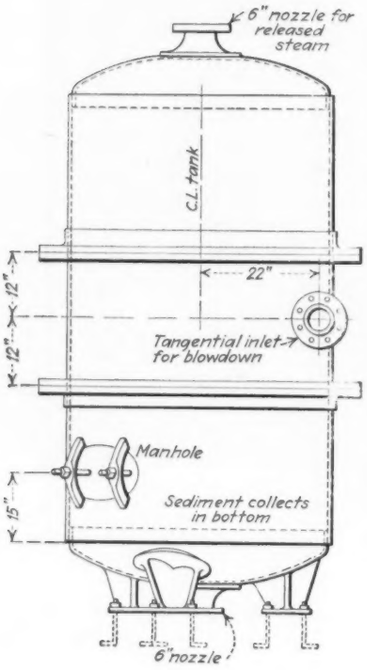
On a six-acre truck farm in Elinore County 1,500 kw.-hr. was consumed in pumping water for irrigation purposes. At the demonstration dairy farm of Robert Jemison, Jr., Jefferson County, 56,000 kw.-hr. was used in 1929 for refrigeration, pumping water, lighting and household purposes. Rural electrification has and will continue to progress just in proportion to the value of electric service to the farmers and to rural communities.



Electric power modernizes farm home and systematizes dairy

On the dairy and truck farm of Emil Graff, Mobile, electricity is used for lighting, cooking and heating water in the home and for lighting, refrigeration, washing bottles, and pumping water at the dairy.

Cyclone Blow-Off Tank Used in Oklahoma Plant



Instead of using an inside-baffled tank to restrain the turbulence of expanding steam when boilers are blown down, the Belle Isle station of the Oklahoma Gas & Electric Company uses a cyclone blow-off tank. It consists of a cylindrical tank with a tangential nozzle at the center connected to the blow-off pipe. The discharge is thus given a circular motion which separates the steam and dirty water, the latter dropping to the bottom of the tank and being drawn off. The central ring of the tank, where scouring action occurs, is a hard steel casting.

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READERS' FORUM

Large Low-Speed Synchronous Motors Have 95% Full Load Efficiency

To the Editor of the ELECTRICAL WORLD:

The letter written by S. A. Staege which appeared in the Readers' Forum of the October 4, 1930, issue of the ELECTRICAL WORLD was a most welcome criticism of the article in the July 19 issue entitled "Selection of Motors in Rubber Mills."

In the last paragraph of Mr. Staege's letter he mentions a concrete illustration of the relative efficiencies of a 250-hp., low-speed, direct-connected synchronous motor as compared with the high-speed geared motor. Mr. Staege states "the guaranteed over-all efficiency of motor and gear unit combined was 91.5 per cent at full load, 91.3 per cent at three-fourths load and 90.7 per cent at half load. . . . ." He then refers to the article in the August *A.I.E.E. Journal* which commented on the above-mentioned high-speed geared motor, and noted that the efficiency was 3.5 per cent higher than the low-speed motor.

Unquestionably the low-speed synchronous motor Mr. Staege referred to in his comparison was very inefficient. The modern low-speed synchronous motor should be given credit for a relatively high efficiency. As another concrete example, a 250-hp., low-speed motor recently installed for a rubber mill drive had an efficiency of 92.5 per cent at full load, 91.6 per cent at three-fourths load and 89.2 per cent at half load. Low-speed mill motors in sizes above the 250-hp. rating will have efficiencies ranging as high as 95 per cent at full load.

C. E. BUCHAN,
Electric Machinery Manufacturing Company, Engineer.
Cleveland, Ohio.

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One Big Family

To the Editor of the ELECTRICAL WORLD:

The writer has been connected with progressive concerns in a number of lines of industry for the past twenty years, and, being progressive, these companies have all experimented with the various forms of employee activity, welfare, personnel and safety activity which the years have brought forth.

As Bill Holland remarked, "Many of these concerns that were originally highly enthusiastic have dropped their efforts in this direction entirely."

Not *all* of the companies of which I speak have discontinued *all* of the various activities, nor have the same ones been dropped in every case, but in general it is safe to say that those that have been discontinued have been the ones which endeavored in one way or another to direct or control the employment of the time or energies of the employee outside of working hours.

Without wishing to take sides in the question, the impression seems to have gained ground that these extraneous activities were for the most part the children of overenthusiastic employment men, who hankered after the more sonorous title of personnel manager.

Foremen's clubs, brought into being with the idea of making more enjoyable the serious business of organizing plant co-ordination by means of meals and social features, admittedly serve a useful purpose, but there is little, if any, justification outside of pure paternalism for the effort and expense incidental to the promotion of purely social or gymnastic activities among the general organization.

The average human being, besides having distinct ideas of his or her own regarding that which constitutes entertainment, also invariably joins with a particular group or circle when it comes to collective amusements. If they are married, it happens more often than not that the out-of-hours social contacts are created and maintained through the family, rather than through shop connections. In any event, it is extremely unlikely that, even though two men are companionable in their shop relationships, they will find that the rest of their families prove especially congenial outside of the shop.

Recreation, entertainment and social intercourse are only attractive to the average person when they can be planned and initiated by the individual of his or her own volition. Any activity conceived, organized and promoted by the employer lacks the vital essential of individual conception and carries with it usually, as well, the stigma which attaches to those affairs, wherein there may be, however unintentionally, a certain sense of compulsive participation demanded.

The idea of "one big family" is theoretically ideal, but experience seems to have demonstrated that this ideal can only be attained in a natural manner, through regular employment, fair treatment and friendly association over a period of years.

Amsterdam, N. Y. D. C. WRIGHT.

Men of the Industry

Changes in Personnel of California Commission

M. B. HARRIS of Fresno was appointed by Governor C. C. Young on January 1 to serve a full term of six years on the California Railroad Commission as successor to Thomas S. Louttit, whose term has expired. Mr. Harris resigned as a member of the State Highway Commission to accept the appointment. He served as a member of the State Senate from 1919 to 1927 and has been active in civic affairs in California for many years. He is an attorney and had practiced law as a member of the firm of Harris, Willey, Griffith & Harris up to the time of his appointment to the commission, resigning to accept the appointment.

FRED G. STEVENOT, who has served as state director of natural resources during the last four years, was appointed by Governor Young to serve on the California Railroad Commission for the remaining two years of the term which W. J. CARR originally had been appointed to serve. Mr. Carr resigned in order to accept a full six-year term appointment to succeed Ezra W. Decoto, whose term has expired. Mr. Carr was originally appointed to the commission by Governor Young in July, 1927, to fill the unexpired term of the late Harley W. Brundige, who four years ago was named by Governor Richardson for a six-year term.

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LYNN S. GOODMAN has been appointed superintendent of the statistical bureau of the Edison Electric Illuminating Company of Boston, succeeding the late Charles H. Hodskinson. Mr. Goodman has been assistant superintendent of this bureau for the past ten years, following two years' service with the International Shipbuilding Corporation as executive assistant and ten years on the staff of Jackson & Moreland, engineers, Boston. He was educated at Bucknell University and the Massachusetts Institute of Technology. Mr. Goodman's work in the field of public utility economics has won him a substantial reputation in the New England territory.

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CHARLES W. AMIDON, president and general manager of the Central Power Company of Nebraska, with headquarters at Grand Island, and also president of the Northwestern Public Service Company, both Insull subsidiaries, has resigned to take an executive position with the Middle West Utilities Company at Chicago. He is succeeded as general manager at Grand Island by V. M. JOHNSON, while JOHN HOGE returns as vice-president. T. T. PARKER, who has been operating official of the Northwestern at Huron, S. D., will succeed Mr. Amidon as president of the two companies. He has also been named as chief executive for the North Dakota Power & Light Company, with operating headquarters at Bismarck, the Northern Power & Light Company of Huron, and the Knife Coal Mining Company, which operates out of Bismarck. Executive headquarters for these five Insull subsidiaries have been opened at Omaha.

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T. K. Quinn and C. E. Wilson New G. E. Vice-Presidents

T. K. QUINN of Cleveland and Charles E. Wilson of Bridgeport, who have been elected vice-presidents of the General Electric Company, as announced in the January 3 issue of the ELECTRICAL

T. K. Quinn

WORLD, have been affiliated with the General Electric organization for a number of years. Mr. Quinn has been manager of the refrigeration department since its formation in 1927. For sixteen years prior to his entry into the field of electric refrigeration Mr. Quinn was a successful worker and later executive in the National Lamp Works of General Electric. He grew up in Chicago, later moving to Cleveland, where he entered the factory of the National Lamp Works, starting as a shipping clerk. Subsequently he went to Nela Park and entered the credit department. He studied law during this period and was admitted to the bar, but never practiced. Instead he became manager of the credit department at Nela Park, then manager of the miniature lamp sales, and finally assistant general sales manager. Mr. Quinn's new headquarters are in New York City.

Mr. Wilson, who was elected vice-president, to have charge of the merchandise department of General Electric, with headquarters at Bridgeport, is a native of New York. At the age of 13 he secured work as office boy with the Sprague Electric Company and worked up until in 1914 he was assistant superintendent and two years later was made manager of switchboard and panelboard sales at the Sprague Works. He was eventually appointed assistant general superintendent of both the New York and Kensington works when General Electric acquired the business of

C. E. Wilson

those plants and later was appointed managing engineer in charge of the conduit and wire section at Bridgeport. In December, 1925, he was appointed assistant manager of the company's

Bridgeport Works, continuing his general supervision of the plant at New Kensington, Pa. In June, 1928, he was appointed assistant to Vice-President Patterson, and on January 1, 1930, he was appointed manager of the merchandise department.

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C. A. Magrath Resigns

CHARLES A. MAGRATH has definitely announced his retirement from the chairmanship of the Ontario Hydro-Electric Power Commission, to which position he was appointed in September, 1925, following the death of Sir Adam Beck. Mr. Magrath's resignation comes as no surprise to his friends and associates as he has been planning to retire for some time. He is chairman of the International Joint Commission and from now on will devote all his time and energy to the commission's problems.

Mr. Magrath has had a varied and distinguished career and his activities in international affairs have won for him a host of friends and acquaintances throughout Canada and the United States. He was Mayor of Lethbridge, Alberta, in 1901 and was for many years identified with irrigation and other engineering enterprises in the western provinces. He was a Member of Parliament from 1908 to 1911 and was appointed a member of the International Waterways Commission in 1911, becoming chairman of the Canadian section three years later. During the war

he was a member of the War Trade Board and was Dominion Fuel Controller in 1917. In 1920 he was appointed chairman of a special committee to investigate agricultural conditions in southern Alberta. No announcement has been made yet as to who will succeed Mr. Magrath as chairman of the hydro commission.

OBITUARY

A. T. Throop

AUGUSTUS T. THROOP, manager of the Eastern Massachusetts Electric Company, Salem, Mass., died recently at Wilmington, Del., in his sixty-fifth year.

Mr. Throop was one of the best-known operating officers in the Tenney group of utilities and had been in charge of the intercompany transmission system serving the north Boston properties of this organization since 1920, when he terminated a three years' connection as general superintendent of the power department of the Wilmington & Philadelphia Traction Company. From 1909 to 1917 he was general manager of the eastern department of the Utica (N. Y.) Gas & Electric Company. He was a native of Port Gibson, N. Y., and after graduating from Lehigh University as a civil engineer he engaged for some years in construction work for the Niagara Falls Power Company, later maintaining an engineering office at Buffalo and doing consulting work for the Southern California Edison Company on the Kern River plant reconstruction job, practicing also in the South and East.

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KILBURN E. ADAMS, for the past eleven years head of the employment department of the Edison Electric Illuminating Company of Boston, died suddenly of heart failure December 24. Mr. Adams was 49 years of age and was educated at Harvard College. He entered the incandescent lamp division of the company in 1903 and was well known in utility circles in eastern Massachusetts.

PROF. EUGEN GOLDSTEIN, one of the most eminent of German physicists, died recently in Berlin in his eighty-first year. The deceased was a pioneer worker on the subject of cathode rays. He confirmed and carried further the discoveries of Hittorf and found the "Kanalstrahlen" or "positive rays," and the so-called second helium-spectrum.

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MERVYN F. FALK, president of the Union Electric Supply Company, Providence, R. I., died suddenly in the company's office as the result of a heart attack. Mr. Falk was one of the incorporators of the supply company when it was organized in 1911 and was recognized as one of the most energetic figures in the electrical supply business in New England. Previously he had been associated with the Sprague Electric Company in New York. Mr. Falk was 49 years of age.

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HENRY M. BATCHELDER, for 28 years treasurer of the Salem (Mass.) Electric Lighting Company, of which he was one of the organizers, died at Salem, January 2, following an operation. Mr. Batchelder was president of the Merchants National Bank of Salem at the time of his death and had spent most of his business life in that field. He took part as a newspaper correspondent in a pioneer demonstration of the telephone between Salem and the Boston *Globe* at Boston in 1877, his message being the first ever delivered to a newspaper by this means.

•

HARRY A. HAMMOND, for many years New York representative of the General Cable Corporation, died January 1, at his home on Riverside Drive, in that city. Mr. Hammond had long been connected with the Rome Wire Company before it became a division of the General Cable Corporation and was well known in Eastern industrial circles. Mr. Hammond was born June 12, 1872, and had been connected with the local wire company in Rome, N. Y., since January, 1903, when it was a partnership of George A. Clyde and Herbert T. Dyett. For a number of years he was a resident of Rome, but he was transferred to New York, where he continued with the sales department and was sales manager of the metropolitan territory at the time of his death.

Financial and Statistical News

HEAVY buying of high-grade utility bonds attributed to institutional buyers has been evident in the market recently and several price advances were recorded. These issues, however, had resisted the heavy selling pressure of the latter part of December, and had less ground to cover on the rally than many others.

——IN THE FACE OF DISCUSSION as to whether or not the power and light companies will encounter any great difficulty in securing the required $900,000,000 involved in the year's budget, under existing market conditions, offerings of the past week exceed $160,000,000, or one-sixth of the total. The bulk of this is long-term money.

——UTILITY COMMON STOCK PRICES CONTINUE TO DRIFT with the market in general and averages are now little above last year's lows.

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Three More Systems Announce Their Budgets

ANOTHER HUNDRED MILLION DOLLARS is going into utility system budgets in 1931, according to announcements made this week.

The boards of directors of Public Service Corporation of New Jersey and subsidiary companies have approved construction budgets for 1931 totaling $26,407,971. This sum is available for expansion of, and additions and improvements to, the electric, gas and transportation branches of Public Service throughout the New Jersey territory served by the operating companies.

Pacific Gas & Electric Company's construction budget for the coming year involves about $40,000,000, according to an announcement just made.

Michigan electric power and gas utilities are planning to spend approximately $40,000,000 in new construction during the coming year, according to a compilation of budget estimates just completed by the Michigan Public Utility Information Bureau. Electric power companies have budgets running close to $33,000,000.

The electric utility plans call for added generating capacity in power houses, construction of transmission lines to reach new territory and to serve better old territory, the erection of office and service buildings, the building of farm lines, the establishing and improving of switching yards and substations and like betterments.

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American Water Works Forms Voting Trust

STOCKHOLDERS OWNING A MAJORITY of the common stock of American Water Works & Electric Company, Inc., have entered into a voting trust agreement under which H. Hobart Porter, president; Chester Dale, of W. C. Langley & Company, and L. Cummings, of Sullivan & Cromwell, will act as voting trustees. The Chemical Bank & Trust Company has been named as depositary for the stock to be deposited under the agreement. The right to deposit stock is to be extended to all holders of common stock. The agreement is to continue for five years.

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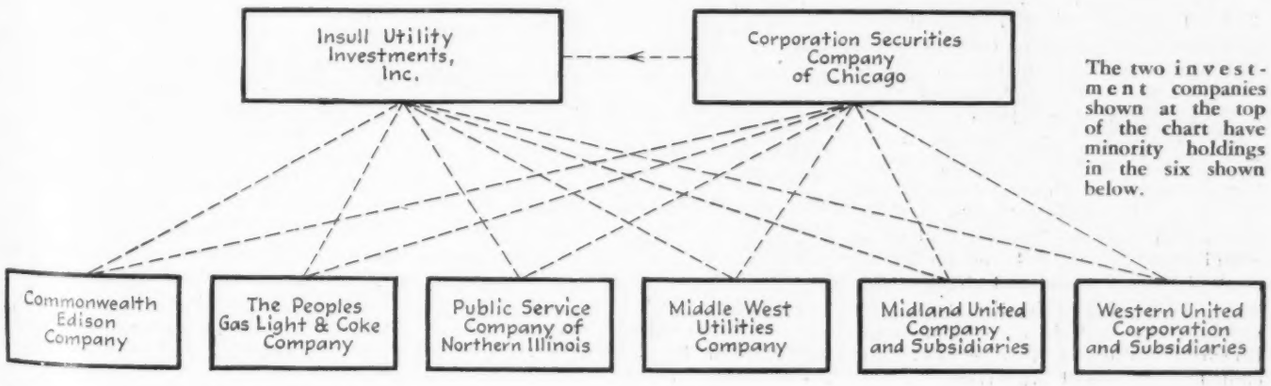
Insull Group Insures Continuity of Policy

WITHIN the past two years there have come into existence in the utility field two corporate entities unique, to a degree, both in function and in structure. Jointly, through minority holdings, they insure continuity of policy and management among the far-flung properties of one of the world's largest utility systems. They are called Insull Utility Investments, Inc., and Corporation Securities Company of Chicago. Need for such a unifying and perpetuating policy arises out of the separate and independent development of the chief Insull properties. Their function has been thus expressed by Samuel Insull:

"Within the last two months I have taken what is, for me, a rather radical step with reference to the ownership, by myself and members of my family, of the securities of the various utility and other concerns in which we are interested. I have felt for some time past that, in the interest of the various properties with which my name is associated, there should be some rallying point of ownership and friendship. So,


Insull Utility Investments, Inc.
Corporation Securities Company of Chicago
Commonwealth Edison Company
The Peoples Gas Light & Coke Company
Public Service Company of Northern Illinois
Middle West Utilities Company
Midland United Company and Subsidiaries
Western United Corporation and Subsidiaries

The two investment companies shown at the top of the chart have minority holdings in the six shown below.

after consultation with my son and my brother, Martin J. Insull, and other members of my family, I decided to form an investment company to buy and hold securities generally, but more particularly to buy and hold the securities of the several companies with which my name is associated.

"I thought it desirable to invite to join me on the board of directors of this corporation my son, my brother, and as many as I could of those closely associated with me in the management and operation of these properties or who are particularly well posted in regard to financing them.

"Such was the purpose for the formation of Insull Utility Investments, Inc. I wanted it, for all time, to be interested in the properties that it has been my privilege either to create, improve or develop, and I thought I could trust its board of directors with the name of Insull, which is of more consequence to me than anything else in the world."

Nominally investment companies

These two enterprises are nominally investment companies with wide powers. But more than 90 per cent of their holdings are in the five major Insull companies. They are fundamentally investment rather than trading companies. They are perhaps the only large corporations of their kind with holdings almost entirely limited to properties under the direction and management of their own directors and officers. Those who control these investment companies have large personal financial interest in them.

Insull Utility Investments, Inc., opened for business December, 1928, with net assets of $18,776,908, comprising utility holdings of the Insull family and the stock of Insull, Son & Company, Inc. By the end of the first fiscal year the company had net assets of $107,621,340, and at June 30, 1930, of $119,004,785. Corporation Securities Company of Chicago was launched October 5, 1929, and its growth also was rapid. At the end of 1929 it had assets less liabilities of $52,235,793 and at June 30 last of $89,416,387.

Thus, two units with assets of $208,000,000 do not directly control, but guarantee the policy and management continuity of the mammoth Insull group of companies with annual earnings of around $400,000,000.

There are two other units, Utility Securities Company and Utility Securities Corporation. These were organized as the investment departments of Commonwealth Edison Company and other Insull companies, and as such are omitted from the attached chart, which deals primarily with the two new organizations and their corporate relationships with the various units included in the Insull properties.

NEW UTILITY FINANCING ACTIVE

Detroit Edison Company

General and refunding mortgage gold bonds, series D.
Amount—$34,984,000.
Price—100 and interest, yielding 4½ per cent.

Detroit Edison Company will use the proceeds from the sale of this issue to refund a like amount of first lien and refunding bonds, comprising $16,665,000 5s and $18,319,000 6s, both due in 1940, called for redemption March 1 next at 105.

Pacific Gas & Electric Company

First and refunding mortgage gold bonds, series F.
Amount—$25,000,000.
Price—98 and interest, to yield 4⅝ per cent.

Pacific Gas & Electric Company will use the greater part of the proceeds of this financing to retire certain bond issues bearing a higher interest rate of the company and recently acquired companies, with a resultant saving in annual fixed charges. The balance will be used for additions and betterments to the company's properties.

Arkansas Power & Light Company

First and refunding mortgage gold bonds.
Amount—$3,000,000.
Price—98 and interest to yield 5.14 per cent.

Arkansas Power & Light Company, which is under the supervision of the Electric Bond & Share Company, supplies electric power and light service to a large part of the State of Arkansas.

Puget Sound Power & Light Company

Secured gold notes.
Amount—$9,000,000.
Price—99¾ and accrued interest to yield 4.75 per cent.

Puget Sound Power & Light Company are offering this issue of one-year gold notes to obtain funds for the payment of $4,425,500 first and refunding 5 per cent bonds, series B, which will mature February 1 and to discharge obligations for plant additions and for other corporate purposes.

Central Illinois Public Service Company

First mortgage gold bonds.
Amount—$3,000,000.
Price—97½ and interest.

Central Illinois Public Service Company's territory includes 465 communities in the State of Illinois. Proceeds from the sale of these 5 per cent bonds, series G, will be used partially to reimburse the company's treasury for the cost of extensions and additions to its property.

Tennessee Electric Power Company

First and refunding mortgage gold bonds.
Amount—$7,000,000.
Price—99 and accrued interest, to yield over 5.05 per cent.

Tennessee Electric Power Company's first and refunding mortgage bonds are secured by a first mortgage on a 56,720-hp. hydro-electric station, a steam station of 53,620 hp. capacity, and other important property, and by a direct mortgage on the entire remaining physical property of the company, subject only to the lien of divisional bonds, of which $21,745,500, or about 67 per cent of those outstanding, are pledged under the first and refunding mortgage. Proceeds from the sale of the present issue will be used to reimburse the company in part for the cost of improvements, extensions and additions to the company's property.

Columbia Gas & Electric Corporation

Gold debenture bonds.
Amount—$50,000,000.
Price—98 and accrued interest, to yield over 5.13 per cent.

Columbia Gas & Electric Corporation has issued these securities with the purpose of raising funds to reduce outstanding bank loans, for capital expenditures and for other corporate purposes.

United Gas Improvement Company

Preferred stock.
Amount—250,000 shares.
Price—98 and accrued dividend.

United Gas Improvement Company will use the proceeds from the sale of this stock to retire the company's floating debt and to provide additional working capital for general corporate purposes.

Texas Power & Light Company

First and refunding mortgage gold bonds.
Amount—$4,000,000.
Price—99 and interest, yielding about 5.07 per cent.

Texas Power & Light Company operates under the supervision of the Electric Bond & Share Company.

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November Brings First Decrease

AFTER PERSISTENTLY HIGHER REVENUES, month by month, than during the preceding year, while most other industries were confronted by more or less severe reductions, electric light and power company reports to the ELECTRICAL WORLD indicate that November revenues in 1930 were 1.5 per cent smaller than in the corresponding month of 1929. This is the conclusion from a preliminary analysis of returns thus far received.

On this basis the November revenue for the entire industry, $190,200,000 in 1929, dropped to about $187,000,000 in 1930. This exceeds October earnings by $4,000,000. The seasonal increase is still in evidence, but is smaller than usual.

Year's Average of Industrial Activity Down 14.6 per Cent

DURING the latter part of December reports of increasing employment in a number of automobile manufacturing plants indicated an upward trend in the activity of that industry. This is confirmed by returns on energy consumption during December. Compared with November, the industry shows an advance of 3.8 per cent, bringing it to a level only 1.9 per cent below that of December, 1929.

The associated rubber industry did not fare so well. It stands 11.5 per cent lower than in November and 22.2 per cent lower than in December, 1929; the year's average, however, is down only 14.2 per cent. Iron and steel was virtually at the November level, 8.5 per cent lower than at the end of 1929, but the metal-working industries gained 4.6 per cent over November; their present stand, 23.1 per cent below the December, 1929, level, is better than in November, when it was down 27.4 per cent.

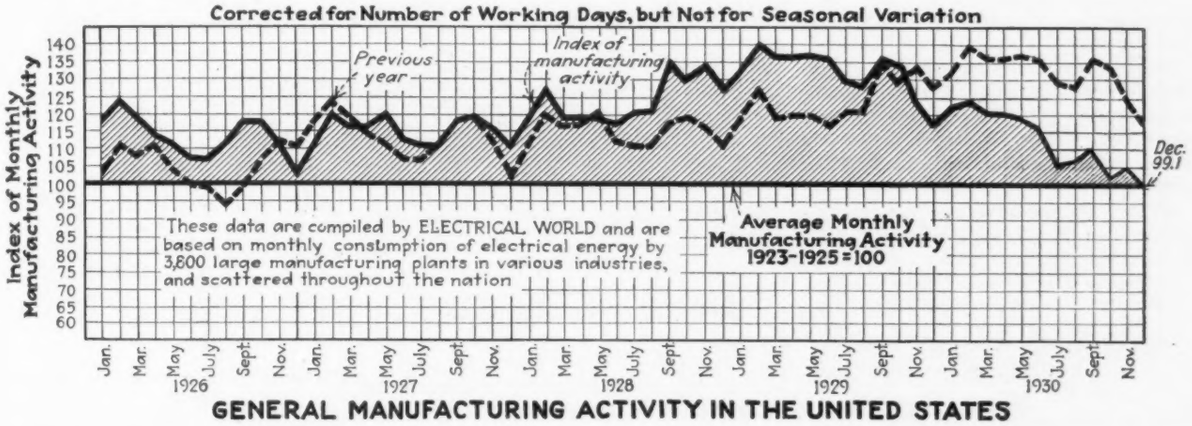
Paper, after a sag in November, returned nearly to the October figure, 11.4 per cent below the preceding December.

Improvements in individual industries were overbalanced by losses in others, so that the weighted average for all industry is down 5.8 per cent from November, 14.8 per cent from December, 1929, and 14.6 per cent for the twelve-month average.

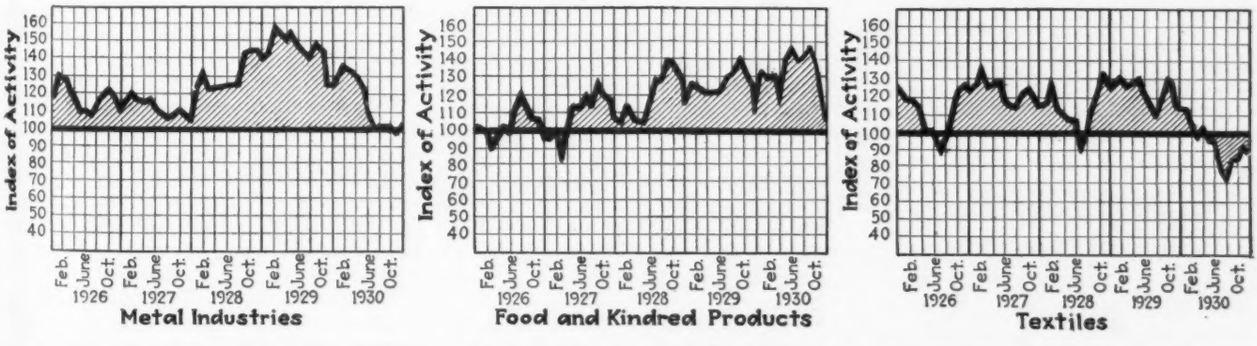
Current Manufacturing Compared with Other Periods

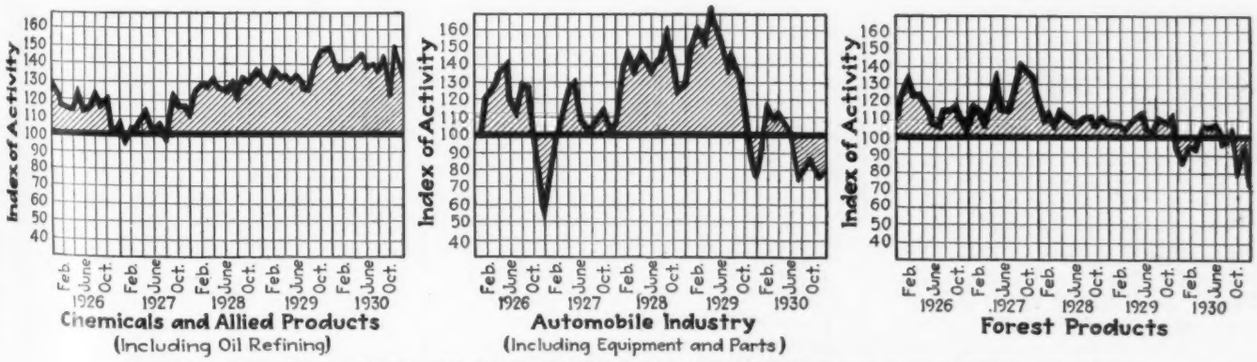
(Per Cent Change)

Industrial group	Dec., 1930, and Nov., 1930	Dec., 1930, and Dec., 1929	Twelve Months of 1930 and of 1929
All industry	— 5.8	—14.8	—14.6
Chemical products (including oil refining)	—11.2	— 9.8	+ 2.5
Food products	—14.2	— 4.4	+ 4.9
Iron and steel plants	+ 0.5	— 8.5	—16.9
Metal working	+ 4.6	—23.1	—23.4
Leather products	— 0.4	—22.8	—12.3
Forest products	—23.1	—21.0	—11.3
Paper and pulp	+15.6	—11.4	— 5.2
Rubber products	—11.5	—22.2	—14.2
Shipbuilding	—29.4	—17.7	+ 6.6
Stone, clay and glass	—15.7	—31.1	—21.5
Textiles	— 4.7	—18.2	—23.8
Automobiles (including parts and accessories)	+ 3.8	— 1.9	—31.9


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
Dec. 99.1
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,600 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES





ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Blaw-Knox Sales for 1930 Close to 1929 Total

FOR THE ELEVEN MONTHS ended November 30, 1930, Blaw-Knox Company had net profit after charges and federal taxes of $2,410,476, equal to $1.82 a share. For the final month of 1930 net probably amounted to approximately $300,000, which would bring per share earnings for the full year to approximately $2. For 1929 net profit totaled $2,828,735, equal to $2.16 a share on the 1,309,727 shares of capital stock outstanding.

During the past year Blaw-Knox has benefited from building programs of public utility companies and from road construction work. Subway and tunnel construction and similar forms of building have also aided sales materially. Concrete forms for such work are leased by Blaw-Knox and it manufactures steel gratings for subways, steel transmission towers, concrete mining machinery and a well-diversified line of materials and machinery having to do with construction work of all kinds. Large road building programs for 1931 indicate a further widening of the company's field of activity.

For the eleven-month period gross sales amounted to $16,605,470, against $17,493,413 for the full twelve months of 1929. Gross profit on sales was $5,303,156, against $6,041,721 for the full year of 1929.

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Gatineau Power Places Order for New Paugan Unit

ORDERS FOR THE waterwheel and generator of the new 34,000-hp. unit which will be installed in its Paugan hydroelectric plant on the Gatineau River have been placed by the Gatineau Power Company. The waterwheel has been ordered from Dominion Engineering Works, Ltd., of Montreal, and will be a duplicate of those now in operation in the power house. It will have an operating head of 135 ft. and a speed of 125 r.p.m.

The order for the generator, also a duplicate of the others in the station, has been placed with Canadian Westinghouse Company, Ltd. It will have a capacity of 28,500 kva., a voltage of 6,600 and a frequency of 25 cycles per second. Being mounted on the same shaft as the waterwheel, the speed of the generator will also be 125 r.p.m. The new unit will be the seventh in the Paugan plant and will raise its installed capacity to 238,000 hp.

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General Electric Announces Course in Illumination

A GENERAL COURSE IN ILLUMINATION containing the groundwork in fundamentals and including the new factors which will be discussed by specialists is to be given by the General Electric Company, February 2 to 7. Several problems will be worked out by the students to give them experience and confidence in actual illumination design. If it is desired, conferences will be arranged with the specialists in the several special fields which, for lack of time, cannot be adequately covered in the regular course of instruction. Some of the lighting problems to be discussed include factories and workshops, stores and show windows, offices, schools, homes, streets and highways, etc.

Would Adjust Unemployment Locally

By J. M. DAVIS

President Lackawanna Railroad

AS I VIEW the situation, this matter of adjusting employment to fit this new condition of affairs is one which can be worked out more advantageously by each locality, in its own way. Each locality has a problem which is peculiarly its own. Obviously, therefore, it can administer that problem more effectively than any outside agency.

By way of illustration, for instance, suppose communities band together, go down to Washington and seek or demand federal aid, and the government acts to alleviate these widely varying local situations by some necessarily more-or-less blanket-form of relief which might very well take the form of a "dole," such as that with which England is struggling. The chances are the aftermath here would turn out to be as it has there—that far too many of those who can collect their dole will not return to work when conditions improve, and thus an entirely new and wholly undesirable problem to be reckoned with is ushered into existence.

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N.E.M.A. SECTION NOTES

The flexible cord group of the National Electrical Manufacturers' Association plans to distribute to those who buy flexible cord N.E.M.A. standard color cards which show colors, color numbers and names.

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The laminated phenolic products section approved for presentation to the standards committee certain proposed standards on laminated phenolic sheets covering the four paper-base grades x, p, xx and xxx.

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Molded insulation section committee is preparing a special accounting manual for the molded products industry to supplement the general manual developed by the N.E.M.A. committee on uniform accounting.

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A conference on the use of electrical equipment for hazardous locations was held January 6 with the Bureau of Mines and Underwriters' Laboratories.

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The equipment grounding committee reviewed a report made to the National Safety Council which dealt with the use of the grounded circuit conductor for grounding the non-current carrying parts of portable equipment and indicated that the method had been tried, but had been discontinued as not being sufficiently efficacious.

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It is reported that 38 sections and groups have appointed technical committees. Among the purposes of such committees are the acceleration of standards work and closer co-operation with the standards committee.

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Definitions, symbols and abbreviations committee considered three propositions dealing with preliminary definitions for miscellaneous electrical terms C42.

graphical symbols for electric power and interior wiring and symbols for heat and thermodynamics MC842.

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American Standards Association committee indorsed approval of the proposed standards on track bolts and nuts B18d-MC841, ultimate fiber stresses of wood poles 05a MC843, and woodruff keys, key slots and cutters MC846.

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C. R. Soderberg of Westinghouse Electric & Manufacturing Company was appointed as a N.E.M.A. representative on the American Standards Association sectional committee on plain limit gages for general engineering work which is now being organized.

Copper Shipments Small

DEMAND FOR COPPER at 10 cents has improved somewhat, but the total tonnage sold during the week was still very small, even though consumers' wants have been fully taken care of. Dates of shipment have been pretty well divided among the next six months. Foreign sales have already improved somewhat.

	Jan. 7, 1931 Cents per Pound	Jan. 14, 1931 Cents per Pound
Copper, electrolytic	10¼	10
Lead, Am. S. & R. price	4.85	4.75
Antimony	7.30	7⅛–7¼
Nickel, ingot	35	35
Zinc, spots	4.375	4.35
Tin, straits	27⅜	25.65
Aluminum, 99 per cent.	23.30	23.30

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Mexico a Heavy Buyer of Our Electrical Goods

FAR-AWAY fields may sometimes look more promising to the exporter. But it would be a mistake to overlook the steadily expanding market for everything electrical, whether it be appliances or heavy equipment, in our neighboring republic, Mexico.

In 1929 Mexican buyers took well over $7,000,000 worth of American electrical goods. Easily 75 per cent of all Mexico's electrical goods originate in the United States. Germany is a keen competitor in certain lines, but proximity favors us. So does the Mexican electrical code and the nature of our products, especially in the equipment field. Electrical manufacturing has not developed extensively in Mexico. There are a few smaller concerns in the manufacturing field, but they are chiefly occupied in assembling imported parts.

The export of electrical goods to Mexico is carried on directly with Mexican dealers, who are to be found in all of the leading cities and larger towns, to a certain extent. Usually these dealers buy from the manufacturers under exclusive territory agreements. In some cases agents are appointed in Mexico City, with sub-agencies elsewhere.

Hydro-electric resources are extensive in nearly all parts of Mexico. The flow is intermittent in most sections, necessitating the building of storage reservoirs. Electricity has been used extensively in manufacturing industries for some years and it has been introduced into mining operations in many districts. Most of the larger mines have electrified railways and hoisting equipment. Furthermore, railroad electrification in general has developed extensively and is proceeding rapidly.

Absence of water power in some districts has led to the building of extensive transmission lines. The energy, serving a considerable area, is distributed almost entirely from large transformers.

The power company status in the leading cities may be illustrated by the situation in Mexico City. The Mexican Light & Power Company has 151,758 customers in the federal district, where the population is approximately 1,000,000. There is no estimate available of the number of wired houses. The company, incidentally, has a separate residence power rate considerably below the lighting rate, so that it is possible to note also the increase in users of current-consuming devices other than light. In 1928 there were 12,068 such consumers of power current in residences and they took 35,032 kw. commercial load. At the beginning of 1930 there were 15,794 home-power-consuming customers and they took 44,669 kw. to run their cooking, heating, washing, cleaning, and cooling devices.

Appliance field offers wide opportunities

In the appliance field there is ample opportunity and a ready market for American goods. Refrigerators are used extensively in the leading cities and a small proportion of these are electric, especially in Mexico City, Tampico and Vera Cruz. Electricity is used widely for cooking and heating and water heaters are used extensively. The electric flat iron is most popular.

In the past there has been a tendency on the part of each dealer to carry several trademarks, including German as well as American, but the tendency to specialize has recently developed.

Appliance stores operated by central stations are plentiful. The Electric Bond & Share group, which recently acquired the British property formerly owned by Lord Cowdray and his associates, has gone ahead with its effective merchandising campaigns. The Mexican Light & Power Company in various cities and towns and local companies throughout the republic has been in this business for several years. These stores have attempted to discourage price cutting. The power companies, along with the larger electrical stores, some years ago instituted the system of installment selling, and this has developed into a very large business.

In connection with wiring and wiring supplies, the government has adopted a national electrical code almost identical with the National Electrical Code of this country, and apparatus approved by the American Underwriters' Laboratories is generally acceptable in Mexico. Rubber-covered wire is invariably used in conduit work and No. 14 is the most popular and widely used. Rigid iron conduit is the most favored tubing. Domestic lighting, in general, follows American practice and an increasing proportion of the materials originate here.

Caution needed at the outset

While indications point to large export opportunities in Mexico, the greatest precaution is necessary on the part of the small manufacturer who is entering the export business in Mexico for the first time. It is essential that a dependable and honest dealer be secured and that the manufacturer acquire a thorough understanding of the market before attempting to ship goods there. In this attempt he will secure very thorough and complete information and valuable assistance from the Bureau of Foreign and Domestic Commerce in Washington.

The generation of electric power and light in Mexico is largely under private enterprise. There are four major companies and some sixty smaller units, and the generation of power bears a much larger ratio to that of light than in this country. A substantial amount of American capital is invested. American & Foreign Power Company controls a number of Mexican power and light properties and in such cases purchasing is largely through the Electric Bond & Share Company in this country. A number of Mexican properties, moreover, are supervised by Electric Bond & Share.

The Mexican Light & Power Company is a Canadian enterprise with its head office in Toronto. In addition several copper mining and similar concerns engage in power generation.

Market Conditions

CENTRAL-STATION orders on the Pacific Coast are much heavier this week and substantial industrial business is in sight. The volume of orders in the Seattle area is expanding with the reopening of lumber and pulp mills. Sizable equipment contracts are shaping up in the Eastern district and public work is becoming an important factor.

——NEGOTIATIONS NOW UNDER WAY in the New England area for heavy equipment are encouraging.

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PACIFIC COAST

—POWER COMPANY BUYING *is very heavy, the past week having included such orders as three 25,000-kva. Westinghouse self-cooled transformers for installation near Fresno, where they will make the primary step-down on a tie-in between the Pacific Gas & Electric and San Joaquin systems.*

Prospective power business includes a carload of No. 2/0 and No. 4/0 bare copper for Glendale and three annual pole proposals amounting to $150,000, $175,000 and $10,000 respectively, for installation in central California and along the coast; $2,000,000 of heavy central-station machinery, including turbine switchboards and transformers, is to be placed in the next few days for the Fresno steam plant. Standard distribution transformers, however, are subnormal in their demand and the very copious rain may subtract something from the prospects for distribution line business. Small motors are very slow, due to lack of industrial buying, but as nearly every plant has run along without much repair work, industrial business should be very much better in the near future. Other interesting orders include electric dredging equipment, valued at $27,500, sold to the San Francisco district; 300 concrete poles at $66 each and 600 metal poles at $85 each sold to the city of San Francisco; a $6,200 street-lighting award by San Leandro and street lighting projects for San Mateo, estimated at $75,000, and Eureka, estimated at $15,000; electric ovens and lathes for the United States government at Mare Island, and a chain of eight $150,000 theaters from Oakland down to Fresno. Residential building permits for San Francisco increased 44 per cent in November over October and some of this gain has been maintained in several districts. Interesting prospective business covers a $1,000,000 film laboratory for Los Angeles with special lighting and protective features, school bonds and construction averaging $300,000 in Los Angeles, Sebastopol, San Francisco and Burlingame, a $300,000 milk plant for Ripon and such special semi-public structures as National Guard encampment buildings at San Luis Obispo, a $1,000,000 old people's home at Pasadena and a $300,000 military academy in Portland.

Signs of revival evidenced last week included reopening of several large lumber pulp and paper mills in the Puget Sound district and logging camps on Olympic Peninsula and Gray's Harbor. Scattered motor sales to these sources are reported and a number of inquiries were received. One firm announced the sale of about twenty machines from 50 hp. down to mills and allied industrials, another 30 machines 25 hp. and under and another a group of distribution transformers ranging from 10 kva. down to local central stations. Bids opened by the Seattle Board of Public Works for sixteen switching units, involving about $4,000 for the Lake Union steam auxiliary and north end substation are being considered and figures were opened January 16 by the board for about $5,000 worth of 300,000-circ.mil, one-conductor, 5,000-volt cable. Pacific Telephone & Telegraph Company will spend $50,000 in Bellingham and $20,000 in Port Angeles for telephone construction and equipment. The Eugene, Ore., Water Board awarded a contract for a power house and service tanks for its steam auxiliary plant for municipal power system to Hargreaves & Lindsay for approximately $25,000.

CONSTRUCTION PROJECTS

Southern California Edison Company, Los Angeles, Calif., plans construction of steel tower transmission line at Stanton and vicinity to cost about $1,500,000, and power substation at Stanton to cost $1,000,000. San Joaquin Light & Power Corporation, Fresno, Calif., has approved plans for steam-operated electric power plant at Herndon, with capacity of 50,000 kw., and will also build power substation at Merced, to cost over $150,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until January 27 for one motor-generator set and spare parts for the San Francisco navy yard (Schedule 4912). Holly Sugar Company, Colorado Springs, Colo., contemplates beet sugar refining plant near Stockton, Calif., to cost over $1,000,000. Overland Terminal Warehouse Corporation, Los Angeles, Calif., plans building to cost $600,000. Seattle, Wash., will soon take bids for superstructure for hydro-electric power plant at Diablo, to cost about $500,000.

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SOUTHWEST

—THERE HAS BEEN *a slight improvement in some lines of electrical business, principally in the industrials. A good volume of orders for motors in sizes suited for factories certainly indicates that the purchasers are getting ready for increased business.*

Utilities have not begun to place orders for material and equipment on their 1931 budgets in any quantity. Contracts reported include a lot of motors costing $25,000 for a large wire rope company that is changing its equipment from 25 to 60 cycles. A fire brick company in the central part of Missouri has ordered equipment to cost $75,000 for improving power factor and a Southern city has purchased 250 pole tops for street lighting to cost $4,000.

CONSTRUCTION PROJECTS

Board of Public Utilities, Kansas City, Kan., will receive bids until January 28 for a one and two-story power plant, reported to cost over $100,000. First National Bank & Trust Company, Oklahoma City, Okla., plans 32-story bank and office building to cost $3,000,000. Empire Oil & Refining Company, Ponca City, Okla., is arranging expansion and improvement program in refining and storage plants in 1931, to cost $3,000,000.

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SOUTHEAST

—ACTIVITIES ARE LOOKING UP *slightly, with inquiries and orders on the increase, and the next few weeks should see some interesting orders placed.*

Bids have been asked on substation equipment for three large power companies in Georgia, Alabama and Tennessee which will aggregate $350,000, this to be used in Georgia to the extent of about $150,000 and about $100,000 each in Alabama and Tennessee. One power company's creosoted pine pole orders in the past ten days totaled $11,410, while its distribution transformer purchases aggregated $7,900 in the same period. A cotton mill in Georgia

ordered meters amounting to $13,000 for installation in its mill village, while an ice plant in South Carolina purchased $1,700 in motor equipment. An independent telephone company in Florida ordered one car of telephone wire during the week.

CONSTRUCTION PROJECTS

Appalachian Electric Power Company, Roanoke, Va., is arranging fund of $1,000,000 for 1931 construction on hydro-electric power plant near Reusens, Va., on James River. Virginia Electric & Power Company, Richmond, Va., plans construction of transmission lines to cost over $500,000. Gulf States Steel Company, Gadsden, Ala., plans expansion in mill to cost over $1,500,000 during 1931. Alabama Power Company, Birmingham, Ala., plans extensions in transmission lines and power substation at Huntsville, Ala., to cost about $100,000.

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NEW ENGLAND

—WHILE FEW SALES *of heavy equipment are reported for the last week, inquiries are being received in good volume and negotiations are under way for several heavy electrical machinery orders, among which are noted new equipment for a hydro-electric plant on the Connecticut River in western Massachusetts and a number of turbo-generators of large capacity.*

—SMALL MOTORS ARE SPOTTY *and, according to one manufacturer, are moving slowly due to pronounced caution on the part of machine tool manufacturers and general industrial interests.*

Correspondingly small switch and control equipment shows an uneven trend though manufacturers are recording encouraging volumes bimonthly. Interest in marine requirements is active and inquiries for electrical equipment are being received in good volume in this district due to unusually active programs in shipyards.

Street lighting, outside special lighting equipment for playground and service stations, and lamps, according to one manufacturer, are outstandingly active. Recently orders for service station installations in good number were noted.

CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until January 20, for one electric furnace for the Boston, Mass., navy yard (Schedule 4860). New England Telephone & Telegraph Company, Boston, Mass., is asking bids for a six-story equipment storage and distributing plant at Watertown, Mass., to cost over $200,000. Texas Company, New York, has filed plans for bulk oil storage and distributing plant at East Hartford, Conn., to cost $200,000.

EASTERN

—CENTRAL STATIONS ARE SHOWING *a better mood for buying in the Eastern district and sizable contracts appear closer to maturity than for several weeks past. An important award has been made for prime movers for a Pennsylvania development and one of the largest marine contracts for many months has been placed. Railroads are entering the market for electrical and mechanical equipment and good orders are anticipated in that quarter.*

—PUBLIC WORK IS BECOMING *an important factor in current demand and inquiries are expanding in this line. While industrial account continues quiet, it is noticeably on the upward trend and there is an improved call for mill motors, control apparatus and accessories.*

Federal Shipbuilding & Dry Dock Company, Kearny, N. J., has secured a contract from the Panama Mail Steamship Company, New York, for the construction of four ocean liners, to cost about $17,000,000, or over $4,000,000 each. The vessels will have a rating of 19 knots and will be equipped with latest type geared turbine drives. In addition to primary and auxiliary power equipment, a large quantity of electrical apparatus will be required for the liners, which are expected to be completed within twenty and 24 months. Each vessel will have accommodations for 222 first-class passengers. Safe Harbor Water Power Corporation, Baltimore, Md., affiliated with Pennsylvania Water & Power Company, has divided an important contract for six generating units between the General Electric Company and Westinghouse Electric & Manufacturing Company, to be used at its hydro-electric generating plant now in course of construction at Safe Harbor on the Susquehanna River, near Holtwood, Pa.; the first-named maker will build four of the machines and the Westinghouse company two. They will have a gross rating of 255,000 hp. Contracts for six hydraulic turbines were awarded a few months ago. The plant will be arranged for the installation of six additional generating units at a later date and will represent an investment of $30,000,000, including a steel tower transmission line to be built by a recently organized subsidiary.

Arrangements have been made by the New York Power & Light Company, Albany, N. Y., with the General Electric Company for the installation of a steam-operated electric power plant in the Schenectady district, utilizing the largest mercury-vapor turbine units yet constructed. The plant will be operated under lease by the utility company and is reported to cost close to $4,000,000.

CONSTRUCTION PROJECTS

Signal Supply Officer, Signal Section, Army Base, Brooklyn, N. Y., will receive bids until January 27 for 2,000 motor alternators (Circular 72). Niagara Frontier Food Terminal, Buffalo, N. Y., has plans for a public market terminal to cost $700,000. Niagara Hudson Power Corporation, Buffalo, N. Y., has authorized expansion and improvements in hydro-electric power plants to cost $4,165,000. American Tobacco Company, New York, will build storage and distributing plant at Lexington, Ky., to cost $500,000. Standard Oil Company of New Jersey, Inc., 26 Broadway, New York, has filed plans for bulk storage and distributing plant at Hackensack, N. J., to cost over $400,000. Philadelphia Electric Company, Philadelphia, Pa., plans substation to cost over $90,000, and will build equipment storage and service plant at Wyncote, Pa., to cost more than $100,000.

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MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section continues to show improvement. Indications that definite resumption of business is in progress are becoming more noticeable. Many favorable reactions are being observed, such as renewed activity in steel mill operations, increased employment on a larger scale in the automotive, electrical, railroad and farm implement industries and building construction.*

The output of electrical energy increased slightly and industrial activity appears somewhat less spotty. The unusually mild weather has permitted more work to go on, with the result that overhead construction and underground conduit work have proceeded uninterrupted almost at full schedules. The demand for distribution equipment is steady, while a considerable amount of apparatus is on inquiry.

CONSTRUCTION PROJECTS

Modine Manufacturing Company, Racine, Wis., will take bids for an addition to automobile radiator plant to cost $80,000. Bedford Cut Stone Company, Bedford, Ind., has plans for plant to cost over $75,000. Libbey Glass Manufacturing Company, Toledo, Ohio, has approved plans for plant addition to cost $500,000. Dayton Green House Manufacturing Company, Dayton, Ohio, plans plant to cost $80,000. Kroger Grocery & Baking Company, Cincinnati, Ohio, plans extensions to cost over $1,000,000 in branch plants in different parts of country. Mutual Heating & Manufacturing Company, Toledo, Ohio, plans power plant to cost about $200,000. St. Paul, Minn., contemplates power plant to cost $250,000. Northern States Power Company, Minneapolis, Minn., plans transmission line at Wabasha, Minn., and vicinity. Iowa Railway & Light Company, Des Moines, Iowa, plans transmission lines in Jasper County. Mount Pleasant, Iowa, plans purchase of steam turbine unit and accessories.

New Equipment Available

Weatherproof Housing for Automatic Switchgear

A DESIGN OF WEATHERPROOF HOUSING which has possibilities of application to various types of automatic switchgear has been announced by the General Electric Company. In the past the outdoor switch house has been confined in general to feeder equipment only. The new modification, while quite different in appearance, carries several of the desirable features characteristic of switch house construction and provides for the enclosure of power line switching equipment, etc.

Standard switch house doors front and rear, each provided for locking, afford access to both sides of the switchboard. Screened ventilators are placed in the sides and under the edge of the roof. These units are portable, being provided with lifting lugs on each side at the top. Leads for control wiring enter through the floor.

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Phase Indicator Has 50- to 500-Volt Range

THE KNOPP PHASE SEQUENCE INDICATOR for determining the correct phase rotation quickly and accurately is announced by the Meter Devices Company, Canton, Ohio. A push button cuts the instrument in, indicating instantly by the rotation of the indicator if the phase sequence is correct.

It is most commonly used in checking connections of watt-hour meters and reactive component meters for determining the correct phase rotation. It is recommended not only as a time saver but also as a means of preventing wrong hook-ups, resulting in incorrect billing. Because of its ruggedness and light weight it is easily carried to the job in the meter man's regular work kit. It has a voltage range of 50 to 500 volts and develops a very high torque, 750 mmg. at 220 volts.

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HINGED INSTRUMENT PANELS, in outdoor switch houses, which permit ready access to the secondary circuits with absolute safety, thus facilitating maintenance and inspection, are announced by the Westinghouse Electric & Manufacturing Company. The secondary circuits and connections are completely exposed when the panel is opened. A steel barrier back of the panel isolates the front compartment from the primary circuits in the rear. Inspection or removal of any relays or instruments can be done without entering the high-voltage compartment.

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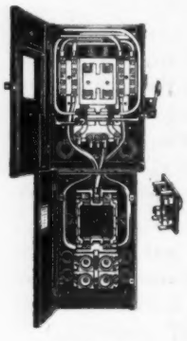
Meter Service Switch Has Test and Plug Fuse Units

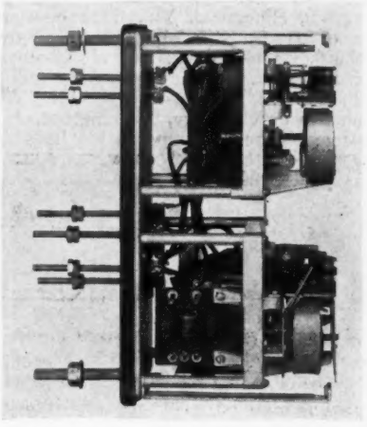
A COMPLETE UNIT that embodies a safety 60-amp. accessible fuse meter service switch with test facilities in the upper part, while the range and four lighting circuits are in the lower part of the cabinet, is announced by the Wadsworth Electric Manufacturing Company, Inc. It is sturdy in construction, with ample wiring facilities and knockouts that are easily and cleanly removed, and is equipped with a shutter containing standardized N. E. L. A. knockouts for standard meters. Neutral terminals for service wire are located in the upper part of the cabinet.



Range circuit and the plug fuse facilities are in the lower part of the cabinet. Plug fuse blocks are of bakelite. The safety cut-out unit consists of a square stationary porcelain base, having attached to the upper and lower walls large contact jaws which are in clear sight and easy to inspect when dead front is removed. The bakelite pull cover can easily be removed from porcelain base for fuse renewals or inspection.

Relay for Directional Overcurrent Protection

A RELAY DESIGNATED AS TYPE IBC, which is used for directional overcurrent protection against phase-to-phase and phase-to-ground faults in an electrical system, has been announced by the General Electric Company. The device consists of a rectangular case which houses a power-directional unit, both of the induction type.



The power-directional unit is supplied with single-throw contacts which can short circuit shading coils which are wound on the pole pieces of the overcurrent unit. The direction of the power flow at the time of a fault thus determines whether the overcurrent unit is to be permitted to develop torque and operate or is to remain in the reset position in spite of any overcurrent that may be flowing. The contacts of the overcurrent unit are connected to the trip circuits of an oil circuit breaker.

The relay contacts are self-aligning, the stationary members being individually adjustable and the movable member a silver disk which provides different points of contact. When the relay has operated, a target indicator is clearly visible from the front of the relay.

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Temperature Regulator Shifts Automatically

A NEW TEMPERATURE REGULATOR for domestic and industrial heating systems is being marketed by the Stat-Amatic Instrument & Appliance Company, Hartford, Conn. It is equipped with an electric motor-wound clock, is fully automatic in operation and has a dual thermostat which maintains the desired temperatures day and night and automatically shifts from day to night temperatures and vice versa. Week-end and holiday reductions of temperature are also automatically provided.